

# Intelligent Agricultural Irrigation Control System

S.Keerthana Sundaravalli<sup>1</sup> H.Amra Jeelani Bijli<sup>2</sup>

<sup>1,2</sup>B.E. Student

<sup>1,2</sup>Department of Information Technology

<sup>1,2</sup>Easwari Engineering College Chennai, Tamil Nadu

**Abstract**— India is country in which agriculture plays one important role in enhancing the country's GDP rate and enriching the country's pride. Hence it is end of the hour of a to emphasize something innovative towards agriculture. Water plays an important role in the world economy. Agriculture consumes more water than any other source and also wastes much of that through inefficiencies. Our proposed system makes efficient use of available water through automatic Water Management system. An Intelligent Irrigation system is the sensor network which senses the information about soil moisture using copper plates and the sensed information is sent to the microcontroller. The microcontroller then compares the sensed soil moisture value with the threshold moisture value. When soil moisture in the field is less than the threshold level, then the motor is turned ON through the registered mobile phone user. When the motor is started, soil moisture is constantly monitored and once the soil moisture reaches the sufficient level then the motor is turned off by the user and the notification is sent to the user through Global System for Mobile communication network. Thus this system can effectively reduce water wastage compared to the conventional systems.

**Key words:** Embedded System, Copper Plates, Wireless Network, Irrigation System, GSM

## I. INTRODUCTION

Agriculture has a significant role in the socio-economic fabric of India. A large portion of Indian population depends on agriculture. Without irrigation agriculture is not possible in dry areas or during the months of inadequate rainfall. Naturally, for the agricultural activities across diverse regions, there is a need for proper irrigation system. Water scarcity is one of the major problems faced by the whole world regarding agriculture. In agriculture lands, there is a continuous monitoring of the water level. At present, the farmers in India are using an irrigation technique that involves manual control at regular intervals. This process sometimes consumes more water or sometimes water does not reach at the correct time due to which the crops get dried. An effective and cost efficient water management system consisting of an automated controller can be developed to help the farmers by managing the water supply to the crop fields. It further maintains the moisture level of the soil that helps in better crop yield within a short period of time. Copper plates are used to sense the information about soil moisture and the sensed information is sent to the Peripheral Interface Controller Microcontroller. Then the sensed soil moisture value is then the sensed soil moisture value is compare with threshold moisture value by the controller. When soil moisture in the field is less than the threshold level, then the motor turns ON with help of GSM, if the soil moisture is reached to sufficient level then the motor is turned off by the user and the notification is sent to the sufficient user through GSM network.

The mobile phone receives an application status from GSM networks. In addition, the mobile phone sends Short Message Service. Then it controls the motor through commands. The main concept of the project is receiving the SMS and processing it further as required to perform several operations. It minimizes the difficulties in the irrigation process and provides more efficient farming techniques.

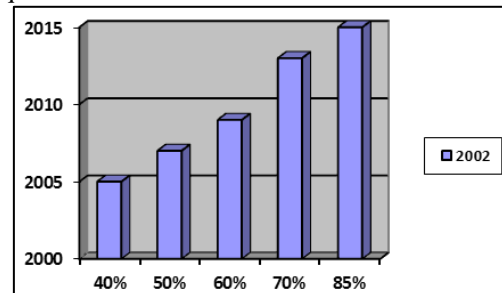


Fig. 1: Growth vs. Corresponding Year

## II. RELATED WORKS

In [1] the objective of the work is to reduce the water usage in irrigation processes. In this regard, wireless sensor network system will continuously monitor the relevant environmental parameters, hydrogen.

cal parameters, soil parameters and crop specific parameters to derive the context. These derived contexts will be used for automatic control and adaptation of the irrigation system to minimize the wastage of water. This research has also proposed a remotely controlled sprinkler nozzle using stepper motor, based on the decisions derived from the multi-sensors deployed in the agriculture field. The system also includes GSM module is used to updates the user about the watering decisions being taken and executed on the fields.

In[2] the system the irrigation controller normalizes the desired moisture level in the agricultural soil by controlling the water flow of the irrigation pump based on the sensor readings, by switching the pump between ON and OFF states. The moisture level in soil, leaf wetness, temperature, humidity, and other essential parameters are monitored efficiently. When the particular command is given by the user, the corresponding sensor is activated and the results are sent to the user mobile using WSN.

## III. SYSTEM OPERATION

The two stiff copper plates are inserted into the soil to sense whether the soil is dry or wet. The distance between the copper plates is the area which is used to sense. The PIC monitors the sensor information. The copper plates sense the area and send an analog input to the microcontroller. The microcontroller checks the condition in the code. The code is written in c through MPLAB software. MPLAB IDE allows writing, debugging and optimizing PIC micro MCU applications for firmware product designs. Through PICKit 2

code is embedded in the microcontroller. If the soil is dry, then the water pump turns ON with the help of user notification through motor driver IC L293D, if the soil moisture is reached to sufficient level then the motor is turned off by the user and the notification is sent to the sufficient user through GSM.

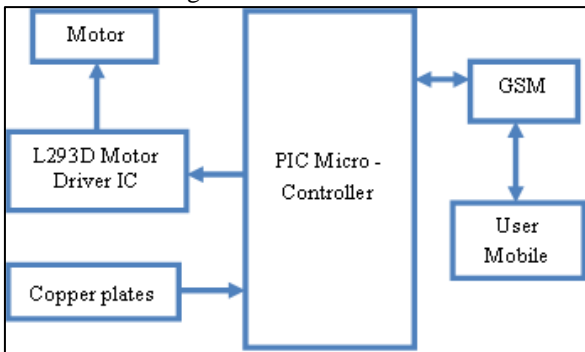


Fig. 2: Automatic Irrigation System

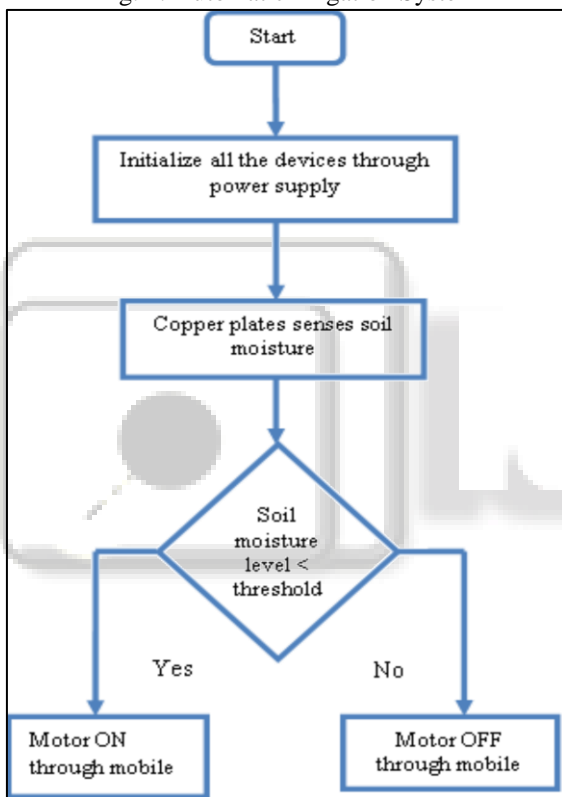


Fig. 3: Flow Diagram

#### IV. HARDWARE DESIGN

The following hardware components are present in the system

##### A. Soil Moisture Sensing

Copper plates are used as soil moisture detector. The plates are inserted into the soil. When the soil is in damp condition, more current will flow between two plates because of the presence a lot of ion  $\text{OH}^-$  and  $\text{H}_2$  from water molecule ( $\text{H}_2\text{O}$ ) and vice versa. The figure below shows the connection setting on two plates. This works on the principle of measuring the level of moisture content in the soil. The first half serves as the anode and the second half serves as the cathode, the soil conductivity RMS a conductive path across the plate and the Voltage across the plate is read off.

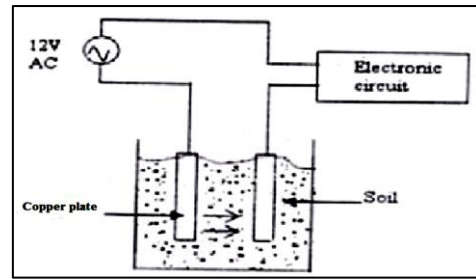


Fig. 4: A.1 Connection using Copper Plates

##### B. Transformer

Usually, DC voltages are required to operate various electronic equipment and these voltages are 5v, 9v or 12v. But these voltages cannot be obtained directly. Thus, the AC input available at the mains supply 230v is to be brought down to the required voltage level.

##### C. PIC 16F877A

Peripheral Interface Controller is a Harvard architecture microcontrollers made by Microchip Technology. PIC has set of registers that function as general purpose RAM. Also called as Programmable Intelligent Computer. The PIC controller was used to offload. The PIC controller was used to offload the I/O tasks from CPU to improve the overall performance of the system. It supports direct, indirect and relative addressing modes. All single cycle instructions except for program branches which are take two cycles. The PIC16F877/876 devices have 8K x 14 words of FLASH program memory. It has 5 basic input/output ports. They are usually denoted by PORT A (R A), PORT B (RB), PORT C (RC), PORT D (RD), and PORT E (RE). These ports are used for input/ output interfacing. In this controller, "PORT A" is only 6 bits wide (RA-0 to RA-7), "PORT B", "PORT C", "PORT D" are only 8 bits wide (RB-0 to RB-7, RC-0 to RC-7, RD-0 to RD-7), "PORT E" has only 3 bit wide (RE-0 to RE-7). The main advantage of this is it can be write-erase as many times as possible because it uses FLASH memory technology.

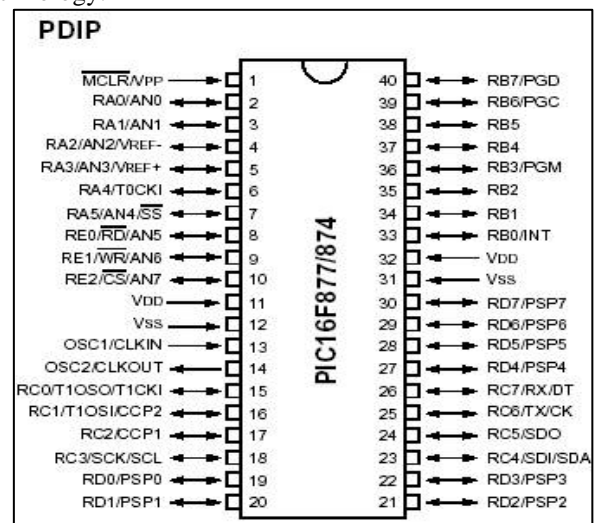


Fig. 5: PIC 16F877A

##### D. Motor Driver IC

L293D is a typical Motor driver or Motor Driver IC which allows DC motors to drive on either direction. There are 4 input pins for L293D. Pin 2, 7 on the left and pin 15, 10 on

the right as shown on Fig.5. Left input pins regulate the rotation of motor connected across left side and right input for the motor on the right side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1. It is a 16 pin IC which can control a set of two DC.

#### E. 7805 Regulator IC

7805 is a voltage regulator integrated circuit shown in Fig 4. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels as shown in Table 1.

Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output, 5V (4.8V-5.2V)	Output

Table 1: 7805 Pin descriptions

#### F. Global System for Mobile (GSM)

GSM is an open and digital cellular technology used for transmitting mobile voice and data services. The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. The SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

### V. SOFTWARE DESIGN

#### A. MPLAB

It is a free integrated development environment for the development of embedded applications on PIC and PIC microcontrollers, and is developed by Microchip Technology. MPLAB X is the latest version edition of MPLAB and is developed by net beans platform. It supports project management, code editing, debugging and programming of microchip PIC microcontrollers. The MPLAB C18 compiler is a free-standing, optimizing ANSI C compiler for the PIC16 microcontrollers (MCU). The compiler deviates from the ANSI standard X3. The compiler is a 32-bit Windows console application and is fully compatible with Microchip's MPLAB IDE, allowing source-level debugging with the MPLAB ICE in-circuit emulator, the MPLAB ICD 2 in-circuit debugger or the MPLAB SIM simulator.

### VI. ADVANTAGES

- 1) Increased agricultural productivity.
- 2) Automatically control the flow of water.
- 3) Efficient use of water.
- 4) No manpower required and is highly reliable.
- 5) Highly Efficient and inexpensive.

### VII. CONCLUSION

The system can be implemented by using copper plates. In consequence, these plates sense the moisture value and send it to the microcontroller. In fact, the microcontroller automatically gives notification as well we turn off the motor if the amount of moisture in the soil rises above the threshold value. This benefits the farmers by saving water and time. Further, farmers can manage the irrigation system remotely and get a better crop growth.

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