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Survey on Computerized Drip Irrigation in Dry Land

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Abstract:

Agriculture plays an important role in India. As we know 70% of our Indian economy is based on agriculture. In today's world farmers can update the humidity and temperature by using the GSM network. The researcher is giving a brief survey on Computerized Irrigation for dry land, through this paper. Earlier, farmer had to perform irrigation process manually. But now, to help farmers a new project called "Micro Controller based drip irrigation system has been introduced, which will make the irrigation process much easier. Artificial application of water to the soil assists in growing crops; for which "Drip Irrigation System" is used. For a big farm land with horticulture activity, the solution will be an automated system. Fresh water resources in agriculture has a crucial importance in Irrigation.

Keywords —**Irrigation, Microcontroller, Sensor, Humidity, Multiplexer, Remote monitoring, Fertilizer, Global system of mobile communication(GSM), Wireless soil moisture sensor, Real time monitoring, Automation.**

I. INTRODUCTION

To make necessary use of water and avoid water wastage, a farmer should have specific knowledge about growing different kinds of plants and crops. So, they need to incorporate new technology in agriculture to increases production and reduces man power. In our country, agriculture is depending only on rain is known as rain-fed farming. Last year due to very less rain fall we are suffering from less crops in our field. Therefore, there is a need of efficient water management.

There are diverse types of irrigation that are used to make appropriate water supply to the fields.

A. Surface

Surface irrigation is divided into furrow, border strip or basin irrigation. It is often called flood irrigation. It is often seen in terraced rice fields, where the method is used to flood or control the level of water in each distinct field.

B. Localized

Localized irrigation includes drip irrigation, spray or micro-sprinkler irrigation and bubbler irrigation.

C. Drip

Drip irrigation system, waterfalls drop by drop just at the position of roots. It is the most water-efficient method of irrigation, if managed properly. Drip irrigation methods range from very high-tech and computerized to low-tech and labour-intensive [3].

D. Sprinkler

Sprinkler system is one of the advanced form of irrigation. In this system, water is piped to many central locations within the fields and distributed by overhead high-pressure sprinklers or guns.

Sprinklers can work in another form as well like automatically moving wheeled systems known as travelling sprinklers may irrigate areas such as small farms, sports fields, parks, pastures and cemeteries unattended [3].

II. LITERATURE REVIEW

This review is performed on the basis of following research papers.

A. Automated Irrigation System by H. T. Ingale and N. N. Kasat

Having proper knowledge of water usage is mandatory. To avoid wastage of water "Automated Irrigation System" has been used which consists of data acquisition, calibration, displaying information and taking decision. The benefits of this system is that it is portable, field usable, reprogrammable and can be used at any geographic positions and weather conditions.

B. Automatic Control of Drip Irrigation System & Monitoring Of Soil by Wireless by Aniket H. Hade and Dr. M.K. Sengupta

According to Hade and Sengupta site-specific wireless system sensor-based irrigation control system is a potential solution to optimize yields and maximise water use efficiency for fields with variation in water availability [2]. Soil moisture sensors and Sprinkler value controllers are being used for site-specific irrigation automation [2]. Its advantages are it has reduced wining and piping costs and easier installation and maintenance in large areas.

C. Efficient Automatic Irrigation and Fertilizer Control System by P Jagatheeswari and B.J Josna

P. Jagatheeswari and Josna explained about usage of Wireless Communication for transfer information which can be short distanced or long distanced. It can be in the form of mobile, two way radios, cellular telephones, Personal Digital Assistants (PDA's) and wireless networking technology.

Wireless is a generic and all-encompassing word used to describe communication in which electromagnetic waves or RF that carries signal over part or entire Communication part. The methodology they used is discussed in section III.

D. A Wireless application of drip irrigation automation supported by soil moisture sensor by Mahir Dursun and Semih Ozden

It has been observed that many of the commercially available sensors, values and modules assembled for irrigation system networks are too complex and costly to be feasible for site-specific management. Drip Irrigation is performed by solar powered pumps. There are 2 pumps involved. Pump1 carries water from Dam Lake to water tank and Pump2 is used for achieving the required pressure for irrigation of orchards.

E. Design of Embedded Systems for Drip Irrigation Automation by Jyothipriya.A.N. and Dr. T. P. Saravanabava

The key elements that should be considered while designing a model are flow, pressure, water supply and quality, soil type and root structure, timing, elevation and watering needs. System Operation to ON and OFF the motor, the farmer needs to send a sms to the authenticated mobile number. Microcontroller checks whether the sms is received from authenticated number and favours working condition to start the motor.

Jyothipriya.A.N. and Dr. T. P. Saravanabava has proposed the following system.

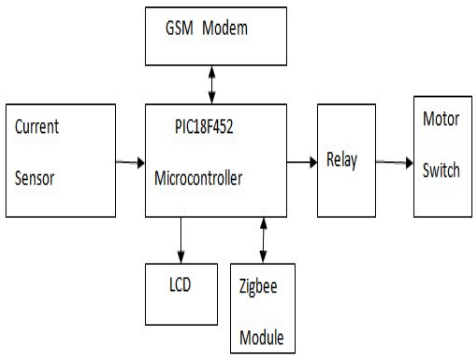

Fig 2.1 Valve Control Unit

[Source adapted from [1]]

III. COMPUTERIZED METHODS OF IRRIGATION

In this section the researcher is trying to give analysis of different computerized methods used for drip irrigation.

A. Controller

H. T. Ingale and N. N. Kasat says that "Micro controller IC 89c52 is heart of our work". This micro controller IC have number of advantages:

1. Internal 64K bytes of electrically erasable programmable read only memory for feeding program so that there is no need of external EPROM.
2. Four 8 bit i/p o/p port out of which we use one port to read ADC o/p other port is use to connect relay and display for operating devices.
3. Operating voltage of 3.5 to 6v D.C. This is easily available by using voltage regulator IC.
4. Internal 128 byte RAM to store temporally storage of data. In which we can feed took up table to turn ON/OFF relay.
5. Two 16 bit time/counter are present for timing and counting purpose.
6. Four external and two internal interrupt are available. Micro controller can read the data available at o/p of A/D converter and store in memory and compare with the set point to turn ON or OFF relay If comparison is equal then operate relay. 12 MHz quartz ceramic crystal is connected between pin XTAL and XTAL of micro controller to produce machine cycle for fetch and execution of instruction. And at pin 9 RST pin we connect R.C n/w to provide reset pulse when power is turn on so those program executions start from memory location 0000H [1].

Implementation

The main aim of this work is to save the water, electricity and improve the growth of plant. Considering farmer's economic conditions, we have prepared a circuit which is cheap and reliable. We have used 89C52 microcontroller for low consumption, low cost, small circuit size and easy to implement. Micro controller can read the data available at o/p of A/D converter and store in memory and compare with the set point to turn ON or OFF relay If comparison is equal then operate relay [1]. 12 MHz quartz ceramic crystal is connected between pin XTAL and XTAL of micro controller to produce machine cycle for fetch and execution of instruction. And at pin 9 RST pin we connect R.C n/w to provide reset pulse when power is turn on so that program execution starts from memory location 0000H [1].

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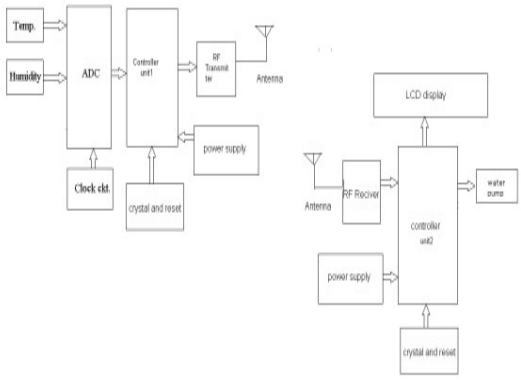
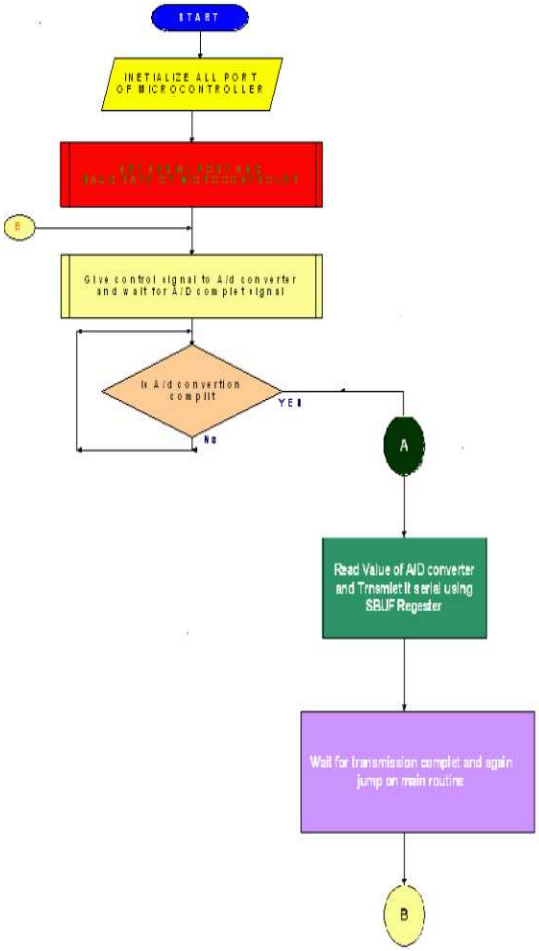


Fig. 3.1 Hardware interface
[Source adapted from [1]]

D. H.T.Ingale and N.N.Kasat has proposed Proposed Dataflow chart.



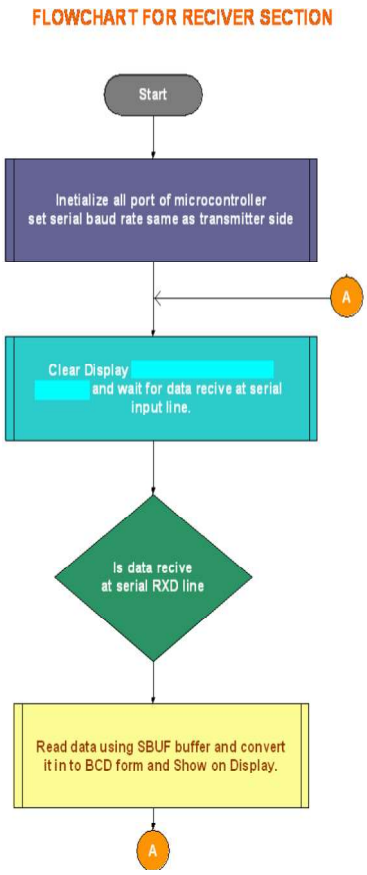


Fig. 3.2 Flowchart for Receiver Section [Source adapted from [1]]

B. **Wireless Sensor Network**

Hade and Sengupta has given the block diagram of the proposed system of input unit shown in fig.3.3 Consists of there are different types of sensing units such as soil moisture sensor to measure the water content in soil, temperature sensor detects the temperature, humidity sensor to measure the presence of water in air, etc.

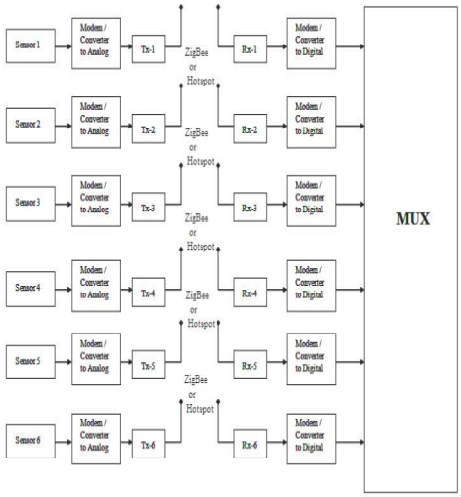


Fig. 3.3 Basic block diagram of proposed system (input part)
[Source adapted from [2]]

The block diagram of the proposed system of control unit is shown in Fig. 3.4 consists of data logger which allows count information to be associated with the date and time, and for the data to be downloaded onto a PC for flexible and detailed data analysis, Demultiplexer split a combined stream arriving from a shared medium into the original information streams [2].

P Jagatheeswari and B.J Josna has proposed the following system.

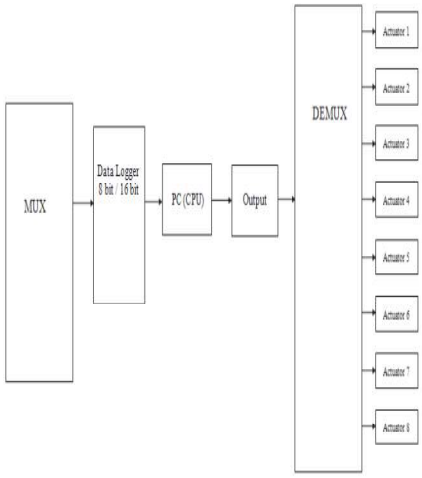


Fig. 3.4 Basic block diagram of proposed system (control unit)
[Source adapted from [2]]

C. Micro Controller

1) I/O Port :

Port A and the Trisa Register

PORT A is a 6-bit wide, bidirectional port. The corresponding data direction register is T TRISA. Setting a TRISA bit (= 1) will make the corresponding PORT A pin an input (i.e., put the corresponding output driver in a High-Impedance mode). Clearing a TRISA bit (= 0) will make the corresponding PORT A pin an output (i.e. put the contents of the output latch on the selected pin). Reading the PORT, a register reads the status of the pins [3].

Port B and the TRISB Register

PORT B is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISB. Setting a TRISB bit (= 1) will make the corresponding PORTB pin an input (i.e., put the corresponding output driver in a High-Impedance mode) [3].

Port C and the TRISC Register

PORT C is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISC. Setting a TRISC bit (= 1) will make the corresponding PORTC pin an input (i.e., put the corresponding output driver in a High- Impedance mode). Clearing a TRISC bit (=0) will make the corresponding PORTC pin an output (i.e., put the contents of the output latch on the selected pin) [3].

Port D and TRISD Registers

PORTD is an 8-bit port with Schmitt Trigger input buffers. Each pin is individually configurable as an input or output. In this mode, the input buffers are TTL [3].

Port E and TRISE Register

PORTE has three pins (RE0/RD/AN5, RE1/WR/AN6 and RE2/CS/AN7) which are individually configurable as inputs or outputs. TRISE controls the direction of the RE pins, even when they are being used as analog inputs.

2) Timer Module

Timer 0 Module

The Timer 0 module timer/counter has the following features:

- 8-bit timer/counter.
- Readable and Writable.
- 8-bit software programmable prescalar.
- Internal or external clock select.
- Interrupt on overflow from FF_h to 00_h.
- Edge select for external clock.

Timer mode is selected by clearing bit TOCS(OPTION_REG<5>).

In counter mode, Timer0 will increment either on every rising or falling edge of pin RA4/T0CKI [3].

Timer 1 Module

The Timer1 module is a 16-bit timer/counter consisting of two 8-bit registers (TMR1H and TMR1L)

Which are readable and Writable.

- As a Timer
- As a Counter

Timer1 also has an internal "Reset input". This Reset can be generated by either of the two CCP modules [3].

D. Using Sensor Unit

Dursun and Ozden has suggested the implementation of Wireless module.

Drip irrigation is performed by solar powered pumps. There are 2 pumps involved. Pump 1 carries water from Dam Lake to water tank and Pump 2 is used for achieving the required pressure for Irrigation of orchards [3].

1) Hardware

There are 3 units involved which are BSU, VU, and SU that contains a RF module, an antenna, a 7V & 1.8W solar panel and low power micro controller chip (MCU) [3].

MCU is selected in terms of the parameters according to cost, processor speed, low power requirements, rapid software development, the ease of system integration with custom circuits.

RF module is chosen for soil moisture sensor RF wireless modules were used to have communication 9.6 kbps with MCU.

2) Wireless Module

RF module is chosen for soil moisture sensor RF wireless modules were used to have communication 9.6 kbps with MCU.

Every module consists of transmitting / receiving function. 60 bytes' maximum length data packing can be sent to transmitter module by MCU which is administrated by the Radio frequency synchronizing protocol.

3) Power supply

There are 2 voltage levels. One is the micro controller (PIC) which runs by a 5V and another is RF module which runs by a 2.7 to 3.3V DC.

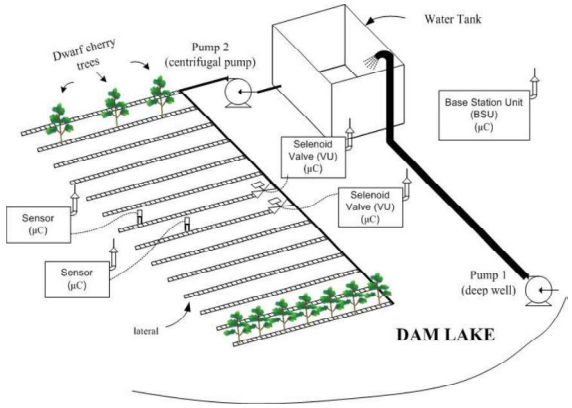


Fig. 3.5 Overview of the system installed in the area [Source adapted from [4]]

Fig3.6 UDEA UFM-M11 RF Module
[Source adapted from [5]]

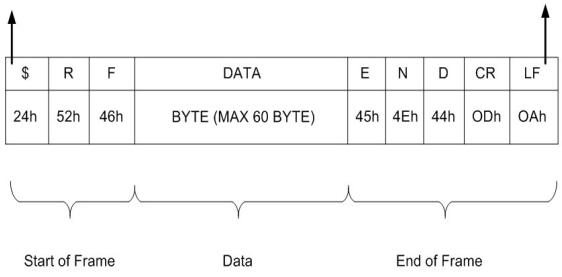


Figure 3.7 RF Module general data format
[Source adapted from [4]]

4) Soil moisture sensor and unit

Mahir Dursun and Semih Ozden suggested that 10 HS has both low power requirement as well as very high resolution. The dielectric constant of the soil is sensitive measure of volumetric water content as it is much higher than that of air or soil minerals.

The SU acquires data given by the ADC, and the data sent to BSU [4]. Different types of sensors can be added easily for future developments [4].

5) Valve unit

Valve unit has an output for controlling the valve. It has same connection and properties with wireless module and SU.

6) Base station unit (BSU)

SU is a master device which is programmed to read and to evaluate sensors data, to control values and to communicate with other units [4].

7) Software

Mahir Dursun and Semih Ozden has proposed the flow chart of the software is shown in Fig3.4.7.

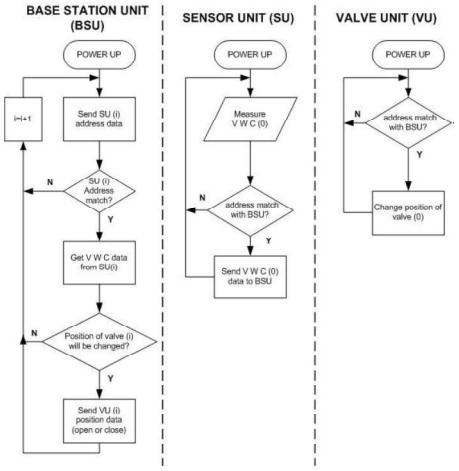


Fig. 3.7 Software flow charts of units.
[Source adapted from [4]]

After power up, the BSU sends address data with sensor numbers to SU. The SU sends moisture data with sensor number [4]. If BSU matches SU data, it can evaluate moisture data SU measures soil moisture and then it sends data. The VU changes position (on/off) after receiving data from BSU.

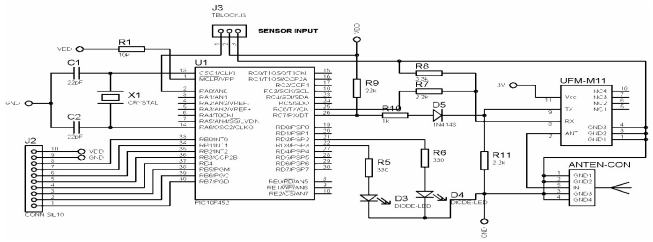


Fig3.8 Hardware Schematic diagram supported by sensor unit.
[Source adapted from[4]]

8) Experimental study

Mahir Dursun and Semih Ozden has proposed the following system. The analog to digital converter (ADC) is referred to an analog value sensed by a PIC microcontroller [4].

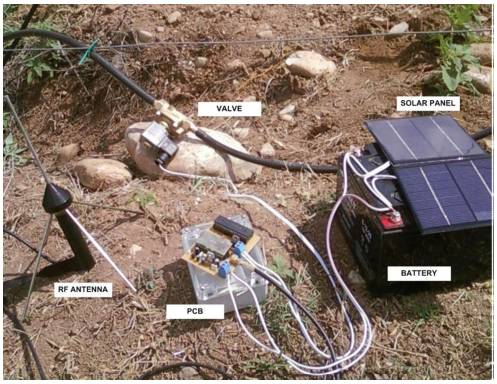


Fig3.9 Application of the valve unit
[Source adapted from [4]]

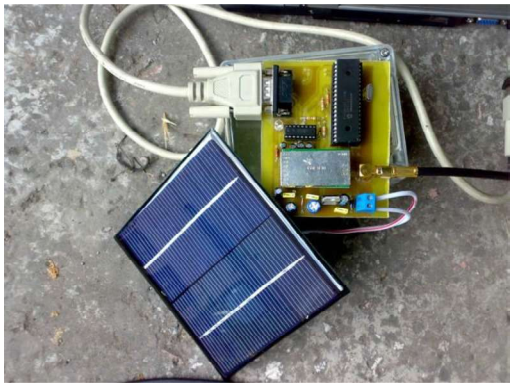


Fig3.10 Application of Base station unit
[Source adapted from [4]]

9) The cost of the equipment

Cost of the equipment are affordable and can be used by growers in their own agricultural irrigations.

E. GSM

Jyothipriya A. N. and Dr. T. P. Saravanabava explained the usage of following components:

Hardware used:

1) PIC 18F452 Microntroller

PIC 18F452 microcontroller has 16k program memory and 1536 Bytes of RAM [5].

2) Current Sensor CT127

The CT127 is used for line frequency from 15 Hz to 50 HZ/ 60 HZ up to 800 HZ current sensing applications.

3) GSM Modem (SIM 900)

GSM module is built with the advance SIM900 engine, works on frequencies EGSM 900 MHZ DCS 1800 MHz and PCS 1900 MHz It is very compact in size and easy to use as plug in module [5].

4) Zigbee Module (RFM70 Transceiver Module)

RFM70 is a GFSK transceiver module operating in the world wide ISM frequency band at 24002483.5 MHZ Burst mode transmission and up to 2Mbps air data rate make them suitable for applications requiring ultra-low Power consumption [5].

5) Relay(RLY102)

The RLY102 provides two SPDT relays with convenient screw terminal connections for the inputs and contacts [5].

6) LCD (Liquid Crystal Display)

LCD screen is an electronic display module and find a wide range of applications. A 16*2 LCD can display 16 characters per line and there are 2 such lines.

7) Solenoid Valve

Solenoid Value is an electromechanically operated value [5]. The value is controlled by an electric current through a solenoid operates at 300 MA, 12V, in case of a two-port value the flow is switched on or off [5].

Table1 Comparison between Manually operated
[Source adapted from [5]]

Crop	YIELD (kg/acre)			WATER USE (m3/acre)		
	Drip	Automated Drip	% saving	Drip	Automated Drip	% saving
Tomato	9808	25050	155.4	1901	1007	47
Capsicum	5340	8900	66.6	2041	1161	43.1
Lady's Finger	3144	7187	128.5	1683	1043	38
Brinjal	5044	8569	70	2483	1488	40
Beans	2255	4100	81.8	1776	1120	37
Cucumber	6200	9000	45	1544	960	38
Bitter gourd	7981	13301	67	3040	1320	57

IV. CONCLUSION

Automated irrigation system is beneficial in many ways and can operate with less manpower. This study helps us to understand the usages of computerized techniques. So that automated irrigation ensures the farmers that there is a hope in agriculture even if they have dry land. That can be achieved with the help of modem gadgets.

V. REFERENCES

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