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AUTOMATION IN DRIP IRRIGATION USING EMBEDDED CONTROL SYSTEM

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Abstract— In the field of Agriculture most vital things are fertility of soil, nutrition's available in soil, water availability in that environmental conditions .All these parameters are playing the major role regarding the productivity of crop .In this paper we tried to go through the various techniques which will show us how to improve productivity with the less use of natural resources like water, and avoid infertility of soil by using fertilizers through drip. This can be used in greenhouse or open conditions to efficiently monitor soil moisture and temperature, ambient temperature, and humidity efficient water utilization and precise irrigation control . India is one of the crucial aspects of irrigation technology and agriculture production. Drip irrigation is widely recommended to use combination of fertilizers and water. The project entitled "Fertilizer" through Drip irrigation using Embedded System" is designed to tackle the problems of agriculture sector regarding irrigation system with available water resources. To improve the efficiency of farmer it is prime requirement to maintain the soil efficiency by providing proper quantity of water to the root zone of crop.

***Index Terms*—Fertigation, Temperature, Humidity, Soil Moisture ,NRF24L01**

I. INTRODUCTION

Drip irrigation helps the freshwater resources in agricultural areas has a crucial and basic importance., because of highly increasing demand for freshwater, minimum usage of water resources has been provided with greater extent by automation technology. Traditional instrumentation based on wired communication presents many difficulties on measuring and control systems especially over the large areas. This paper describes an major application to a wireless sensor network for low-cost controlled irrigation solution and real-time monitoring of water content and moisture of soil. The obtained irrigation system not only prevents the moisture stress of plants and but also provides an efficient use of natural resource. The data available from the various sensors will be received at the receiver section for proper control, based on data

The prime aim is to select the appropriate wireless circuit to collect the data from moisture sensors, water soluble fertilizer sensor placed in the field, temperature sensors of various areas in the field, pressure sensors in the irrigation system to monitor the proper drip of water along with the fertilizer which are kept in a separate tanks.

Another addition of the proposed automation system is to install the timer to monitor the overall condition of the field. In addition, the developed irrigation method partly removes the excess burden of the farmers.

To identify correct sensors and monitoring device required for the farming data like soil moisture, temperature the process is completed and done with the help of narrow tubes that will give water directly to the base of the plant. Best way to this problem is Drip irrigation system and Sprinkler irrigation. Sprinkler is beneficial for those crops which needs water spray over the ground.

With the help of drip irrigation system we can also give the fertilizers to crop. This process is called as fertigation. Fertigation has the potential to ensure that the correct combination of water and nutrients is available at the root zone, satisfying the plants total requirement of water and nutrient.

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II. METHODOLOGY OF SYSTEM

The measured for automation of irrigation system are soil moisture and temperature. LM35 can be used as a temperature sensor can be used as the moisture sensor to detect and sense the moisture contents of soil. The moisture sensors are put in the ground at required depth. Once the soil has reached the required moisture level the sensors send a required signal to the micro controller will turn off the relays, which control the ports. The signal send by the sensor is come up to the required level by corresponding amplifier stages.

A LCD module here can be used in the system to monitors current readings of all the sensors and the current status of respective valves. A Chemical injection unit is used to mix required quantity of fertilizers, with water, whenever required. Pump is used for similar distribution of fertilizer in the field. A flow meter is attached for supply of total water required for irrigation. The required readings can be transferred to the Computer on the receiver side for further analytical studies, through the wireless mode. Using this methodology the data can be transferred to the receiving place. So the user can access the data situating at his workplace. While applying the automation on bigger fields more than one such micro controller units can be interfaced wirelessly to the receiver side.

III. HARDWARE DESCRIPTION

Types of sensors:

1. Temperature sensor
2. Soil moisture sensor

1) Temperature sensor

The temperature sensor used to measure the temperature in the field is LM 35.The LM35 series is precision integrated-circuit temperature sensors and its output voltage is linearly proportional to the Celsius also known

as Centigrade. The LM35 does not require any external calibration or voltage to provide typical accuracies of degree C at room temperature and degree C over a -55 to +150øC temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's has low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry making it easy.

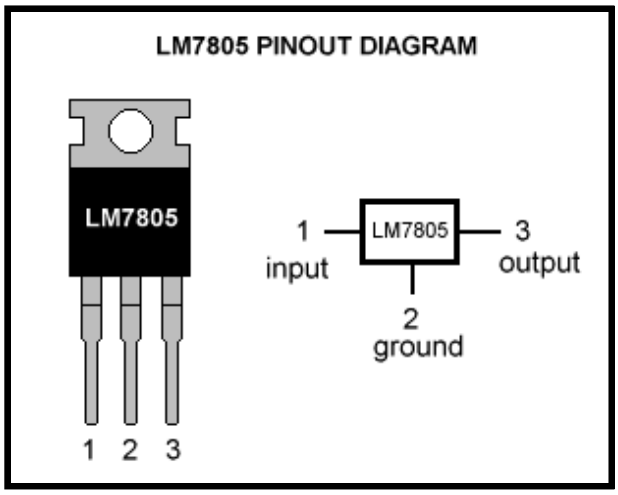

Fig: Temperature Sensor

2) Soil moisture sensor

The soil moisture sensor used is capacitive type. The sensor gives output of zero volt in the analog form of signals. when there is100% moisture and 5V for 0% moisture The electrical resistance type of soil moisture sensor, which is pictured in Figure 2,converts electrical resistance from the sensor to a standard reading of soil water content measured in soil water potential, which is given in bars or graph.

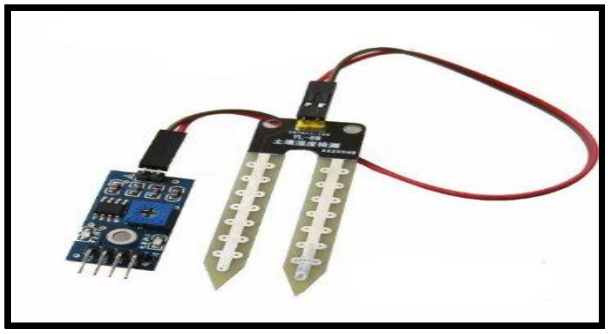

Fig: Soil Moisture Sensor

NRF:

The nRF24L01+ is designed for operations globally wide range in ISM frequency band at 2.400 - 2.4835GHz. To design a NORDIAC RADIO FREQUENCY system with the nRF24L01+, you simply need of an (microcontroller) and a few external passive components. You can operate the nRF24L01+ through a Serial Peripheral Interface also known as (SPI). The register map, which is accessible through the SPI, contains all configuration registers in the nRF24L01+ and is accessible in every operation modes of the chip. The embedded base band protocol engine (Enhanced Shock Burst™) is based on packet communication and supports various modes from manual operation to advanced autonomous protocol operation. Internal FIFO ensure a smooth data flow between the radio front end and the system's micro controller. Enhanced Shock Burst™ reduces system cost by handling all the high speed link layer operations.

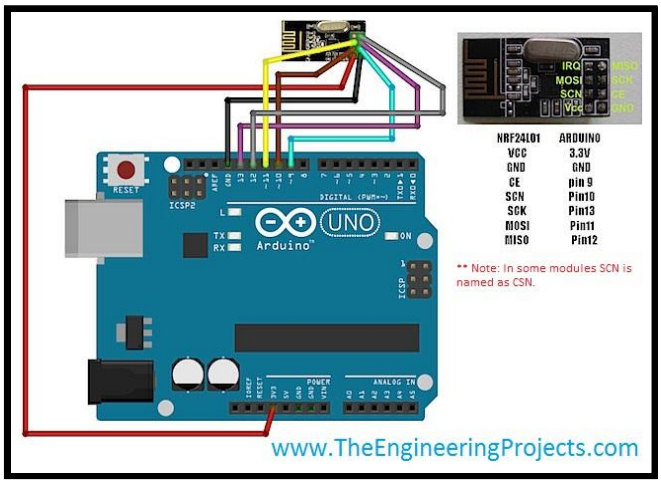

Fig: NRF24L01

The front end uses GFSK modulation. It has user configurable parameters like frequency channel, output power and air data rate. and nRF24L01+ supports an air data rate of 250 kbps, 1 Mbps and 2Mbps. The high air data rate combined with 2 power saving modes make the nRF24L01+ very suitable for ultra low power designs. nRF24L01+ is drop-in compatiblewithnRF24L01and on-air which is compatible with nRF2401A, nRF2402, nRF24E1 and nRF24E2. wideband blocking values in nRF24L01+ are much improved as compare to the nRF24L01 and the addition of internal filtering to nRF24L01+ has improved the margins for meeting RF regulatory standards.

Key Features

- Worldwide 2.4GHz ISM band operation
- 250kbps, 1Mbps and 2Mbps on air data rates
- Ultra low power operation
- 11.3mA Transmitter at 0dBm output power
- 13.5mA Receiver at 2Mbps air data rate
- 900nA in power down
- 26µA in standby-I

ATMEGA 16:

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with very low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions

execute in one machine cycle. Atmega16 can works on at most frequency of 16MHz.

ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM is of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively.

ATmega16 is having a 40 pin microcontroller. There are total 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD.

ATmega16 includes in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task that is related to in-built peripherals. The following table shows the pin description of ATmega16.

High-performance, Low-power AVR 8-bit Microcontroller
• Advanced RISC Architecture
–131 Powerful Instructions
–Most Single-clock Cycle Execution131PowerfulInstructions Most Single-clock Cycle Execution
– 32 x 8 General Purpose Working Registers
– Fully Static Operation is present
– Up to 16 MIPS Throughput at 16 MHz
–On-chip 2-cycle Multiplier
• High Endurance Non-volatile Memory segments
–16K Bytes of In-System Self-programmable Flash program memory
– 512 Bytes EEPROM
– 1K Byte Internal SRAM
– Write/Erase Cycles: 10,000 Flash/100,000EEPROMDt t ti 20 t85°C/100 t 25°C(1)
–Data retention: 20years at85°C/100years at25°C(1)– Optional Boot Code Section with Independent Lock Bits
In-System Programming by On-chip Boot Program True Read-While-Write Operation– Programming Lock for Software Security

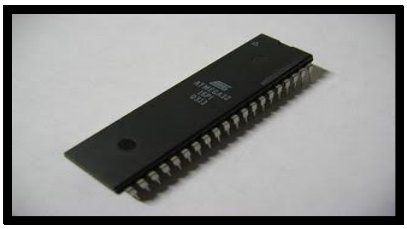

Fig: ATMEGA 16

IV.WORKING

The two Transceivers are designed .Here System works in two sections

1) Transmitter
2) Receiver
Working starts with two transceiver which consists of

Transmitter

The communication between these transceivers are bidirectional in this project .when we switch the power on the system gets reset .the sensors in the field transmit the information in the form of signals and these signals are given to the microcontroller 328pu then it transmit to microcontroller Atmega 16 for monitoring.

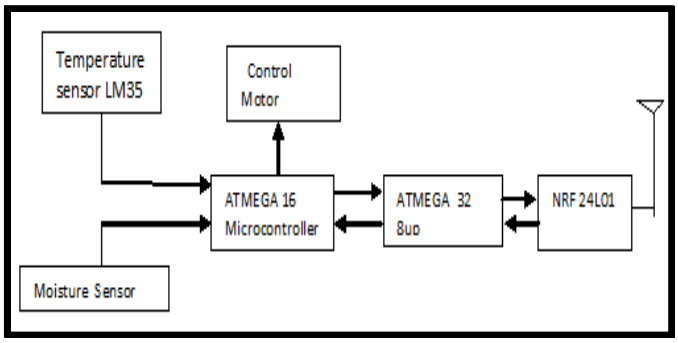

Fig :Transmitter

Microcontroller Atmega 16 process the received information from sensors by checking the levels of value sent by sensors .Through 8 channel ADC point are taken as output to microcontroller .To initiate the process, output is given to NRF through Tx and Rx pins

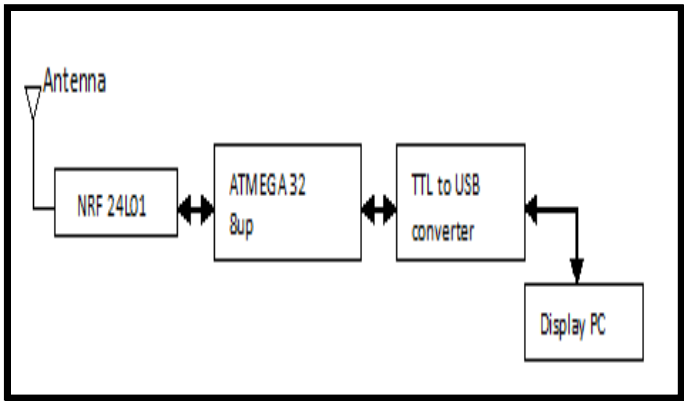

Fig: Receiver

Receiver

Now at the receiver side NRF receiver is present .The transmitted signal is received and given to the microcontroller to verify the parameters such as temperature, moisture level of the soil .the data send by the sensors used are monitored on computer using USB A to B cable. This provides accurate information regarding farming aspect.
When the threshold value of moisture level in soil and temperature goes low then automatically microcontroller commands the motor to pump the water which is stored in tank and water is pour in the field drop by drop. Along with this operation fertilizer is also supplied in the field simultaneously in the required amount .for this separately timer has been set The microcontroller unit warn the water pump failure or insufficient amount water input

with the help of LED indicator .hence ,it helps to provide large area irrigation with low water usage

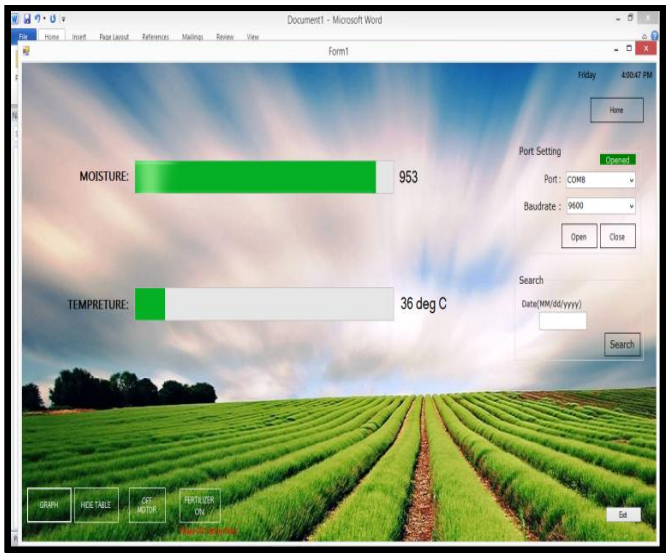

Fig: Output from the temperature and soil moisture sensors

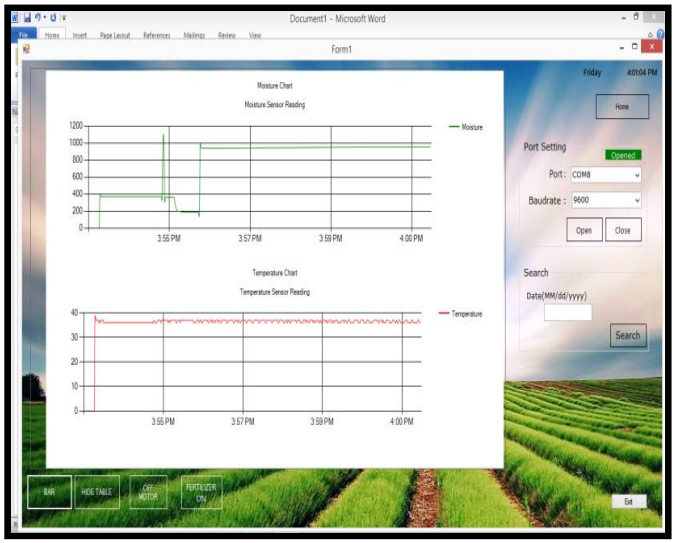

Fig: output graphical representation from receiver side

ADVANTAGES

If different kinds of sensors (temperature, humidity etc.) are involved in such irrigation in future works, it can be said that an Internet-based remote controlling of irrigation automation will be possible.

The developed system can also transfer proper amount of fertilizer and the other agricultural chemicals (calcium, sodium, ammonium, zinc) to the field with adding new sensors and valves For the further action taken this system help the farmer to save the water as well as it will reduce effort of the farmer of water control action for the irrigation.It is safest and no manpower is required after the system installation. Permits other yard and garden work to continue when irrigation is taking place, as only the immediate plant areas are wet. The drip system reduces soil erosion.

CONCLUSION

By using this embedded technology we can efficiently controls and monitors the drip irrigation system using the Microcontroller. By using this system, we can save the man power , efficient usage of water so we can have the profit ultimately. This automated system which have application in commercial production of crops can be proposed easily since it is low cost and reliable too. The transfer of fertilizers such as calcium, potassium, zinc,ammonium in the field is also possible with the sensors and valves.

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