Automatic Irrigation System Using DTMF

Amit Verma, Ankit Kumar, Avdesh Sikarwar, Atul Sahu

Abstract— **The main aim of this paper is to provide automatic Irrigation System using DTMF technology for Indian farmers with a facility to operate a motor at a distant and controlled using microcontroller 8051. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator, Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and givesan interrupt signal to the micro-controller and thus the motor is activated and if the power supply is off we can start the motor with the help of DTMF.This paper represents the prototype design of microcontroller based automaticirrigation system which will allow irrigation to take place in zones where water in gisrequired, while by passing zones where adequatesoilmo is tureis in dicated.**

Index Terms— **Microcontroller; DTMF; Sensor; Motor**

I. INTRODUCTION

Nowdays,watershortageisbecomingoneofthebiggestproblemintheworld.Manydifferentmethodsaredevelopedforconservationofwater.Weneedwaterineachandeveryfield.Inourdaytodaylifealsowaterisessential.Wateris consideredtobebasicneedofhuman.Waterisneededforeveryonehuman beings,animals,plants,etc. Agricultureisoneofthefieldswherewaterisrequiredintremendousquantity.Wastageofwatermajorprobleminagriculture.Everytimeexcessofwaterisgiventothefields.Therearemanytechniquestosaveortocontrolwastage of waterfromagriculture.

A. DitchIrrigation

DitchIrrigationisarathertraditionalmethod,whereditchesaredugoutandseedlingsareplantedinrows.Siphontubesareusedtomovethewaterfromthemainditchtothecanals.

TerracedIrrigation

Thisisaverylabor-intensivemethodofirrigationwherethelandiscutintostepsandsupportedbyretainingwalls..Theflatareasareusedforplantingandtheideaisthatthewaterflowsdowneachstep.Wateringeachplot.Thisallowssteep landtobe usedforplantingcrops.

B. DripIrrigation

Thisisknownasthemostwaterefficientmethodofirrigation.Waterdropsrightneartherootzoneofaplantinadripping motion.If the system is installedproperly you can steadily reducethe lossof waterthroughevaporationand runoff.

C. SprinklerSystem

Thisisanirrigationsystembasedonoverheadsprinklers,spraysorguns,installedonpermanentrisers.Youcanalsohavethesystemburiedundergroundandthesprinklersriseupwhenwaterpressurerises,whichisapopularirrigation system foruseongolfcoursesand parks.

D. Rotary Systems

Thismethodofirrigationisbestsuitedforlargerareas,forthesprinklerscanreachdistancesofup to100 feet.Theword"Rotary"is indicative of the mechanical driven sprinklers movingin a circularmotion, hence reaching greater distances.This system watersalargerareawithsmallamountsofwaterovera long periodoftime.

E. NEED OF DTMF IN IRRIGATIONSYSTEM:-

Automaticirrigationsystemsareconvenient,especiallyforthosewhotravel.Ifinstalledandprogrammedproperly,automaticirrigationsystemscanevensaveyoumoneyandhelpinwaterconservation.Agriculture is a source of livelihood of majority Indians and has great impact on the economy of the country. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. So, it needs to be automated for proper yield and handled remotely for farmer safety. In this paper we suggest a Wireless sensor network and Embedded based technique of DTMF (Dual Tone Multiple Frequency) signaling to control water flow for sectored, sprinkler or drip section irrigation. This system will be very economical in terms of the hardware cost, power consumption and call charges.

II. SOFTWAREANDHARDWAREPLATFORMUSED:-

A. Hardwareused

Microcontroller,ADC,Humiditysensor,Voltageamplifier, comparatorcurrenttovoltageconvertor,temperaturesensor,solenoid,diode resistorsandcapacitors.

Amit Verma, Department of Electronics and Instrumentation Engineering ITM, GWALIOR
Ankit Kumar, Department of Electronics and Instrumentation Engineering ITM, GWALIOR
Avdesh Sikarwar, Department of Electronics and Instrumentation Engineering ITM, GWALIOR
Atul Sahu, Department of Electronics and Instrumentation Engineering ITM, GWALIOR

B. Softwareused

Multisim 10.2,diptrace,side51, Kiel Software.

III. BLOCKDIAGRAM:-

A. Humiditysensor

Thehumiditysensorjustsensesthehumidityorthemoistureofthesoil.Thechangeinhumidityisproportionaltotheamountofcurrentflowingthroughthesoil.Thehumiditysensorsavailableinmarketaretoocostlytobeusedforsuchsmallhouseholdapplications.Sofordomesticpurpose,wehavedesignedasimplehumiditysensorwhichworksontheprincipleof the conductivityof soilWhenever the soil is dry the conductivity of soil less andvice-versa.

Ourhumiditysensorconsistsoftwometalrodsandits have

9Vbattery.The twoconductingmetalrodusearofAluminium.Thesetworodsare separatedbywoodenblockforsup-portingthetworodsandkeepingthespacingbetweenthemconstant.Thetworodsareinsertedinsoil.The9Vbatteryisconnectedinserieswiththeserods.So,thecurrentflowsfromthe rodsthrough the soil.Here,if soilis dry,currentflowingisnegligible.Andifsoiliswet,currentissensed.Thiscurrentisthen convertedintovoltage using Itovconverter.

B. ItoVconverterandvoltageconverter

The currenttovoltage converterconvertscurrentcomingfromthehumiditysensorintovoltageandthisvoltageisgiventothe voltage amplifierforamplification.

C. Comparator

Itcomparesthereferencevoltageandtheamplifiedvoltagecoming fromItoVconvertor.

D. TemperaturesensorandLM339

ICLM35sensesthesurroundingtemperature.The outputofthisICisanalog voltage. This voltage isgiventotheLM339forcomparing the presentcondition with theidealone.

E. Microcontroller

The entire automationis done using microcontroller.

F. Designofpowersupply

Powersupply consistsofatransformer,bridgerectifier,andvoltageregulatingICs7805,7812,7912.+5V,-5V,+12VDCpowersupply is designedtoprovide VCCas wellasreference voltagetothevariousICs .

G. Step down transformer

Stepdowntransformerconverts230VfromACmainsinto15VAC haveusedacentertaptransformerhaving-15V,0V,15Vand0.5ampere.TransformerselectionisbasedonthefactthatregulatorICsrequire around 14vasinputconsideringdropoutvoltage(around2v),inordertoobtain12vpowersupply.AndcurrentdemandofICs741,ADC,microcontroller,comparatoretc., issatisfied using500mAtransformer.

Transformerstepsdownacvoltagefrom230vacto15vac.Itisthengiventobridgerectifier.Bridgerectifierconvertsacvoltageintopulsatingdc.ItisthengiventoregulatorICswhichoutputconstantdcvoltage.ThesevoltagesaregiventootherICsasVCCorreference.OutputsofICs7805,7812

&7912are +5v,+12v&-12vrespectively.

H. Bridgerectifier

Rectifierconvertsacvoltage intodcvoltage.4diodesareconnectedinbridge.Itsinputisfromtransformerandout-put is giventothevoltageregulatorIC's.

I. VoltageregulatorIC

VoltageregulatorICgivesconstantDCvoltageatoutputin spite offluctuations ininput.

J. Temperaturesensor ICLM135

LM35ICsensesinstantaneoustemperature,andconvertsitintovoltage.ThisvoltageisthenamplifiedandgiventoADC.

K. ItoVconverter IC 741

ThisICconvertscurrentintovoltage.IC741isusedforthispurpose.Outputvoltageis thenamplifiedandgiventocomparator.

L. Voltageamplifier741

Thisamplifiesthevoltagegivenasaninputtoit.Itsgainiscalculatedas:-

$$A_v=1+Rf/R1$$

M. ComparatorICLM339

ComparatorICLM339compares2voltages.Vrefisadjustedby adjusting pot.Vrefis given by formula:-

$$V_{ref}= (R2/ (R1+R2))X5$$

WehaveusedtwocomparatorICs.AsdiscussedabovethefirstcomparatorICcomparesamplifiedvoltagefromItoVconvertor.NowthesecondcomparatorICisusedtocomparedifferenttemperatureconditions.LM339ICHasfourinternalcomparators.Outofthosefourcomparatorsweareusingonlytwocomparators.Theonecomparatorcom-pareswhethertemperatureisaboveorbelow

20degreeCelsius.Anotheronecompareswhethertemperatureisaboveorbelow30degreeCelsius.TheoutputofthisIcisgiventotheMicrocontroller.

N. Micro controller ICAT89C51

Programis given tomicrocontrollertocheck values oftemperatureandoutputofcomparatorwhichcomparestheVrefandamplifiedvoltageofItoVconvertor,andmaketheLED'ON'forparticulartimeinterval.Timeintervalisdiffer-entfordifferentrangesoftemperatureprogramiswritteninassemblylanguage

O. Flip FlopIC7474

MicrocontrollerAT89C51hasclockfrequency12MHz.ForADC0808,680 KHzfrequency isrequired.. So, thisfrequencyisderivedfrommicrocontrollerclockusingflipflops.IC 7474is used as flipflopIC.

P. LED

Itindicatestheneedofsprinkler.WhenLEDison,thatmeanssprinklershouldbeon.Ifitisoffthereisnoneedof water.

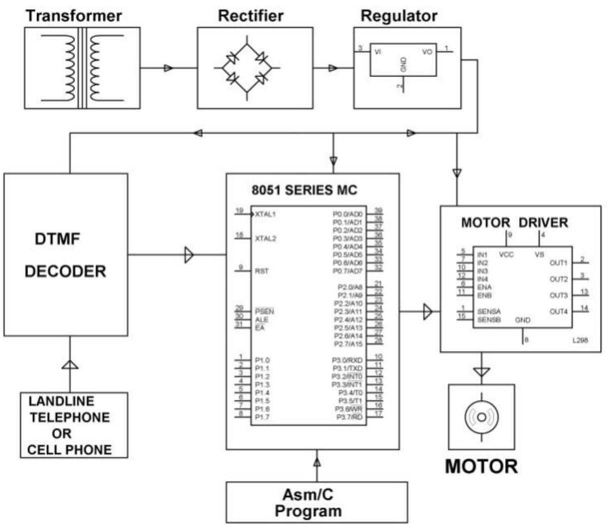

Fig.1

IV. Future Scope:

A. Saves water - Studies show that drip irrigation systems use 30 - 50% less water than conventional watering methods, such as sprinklers.

B. Improves growth - Smaller amounts of water applied over a longer amount of time provide ideal growing conditions. During irrigation extends watering times for plants, and prevents soil erosion and nutrient runoff. Also, because the flow is continuous, water penetrates deeply into the soil to get well down into the root zone.

C. Discourages weeds - Water is only delivered where it's needed.

D. Saves time - Setting and moving sprinklers is not required. A timer delay as per environment can be added to the system for automatic watering.

E. Helps control fungal diseases, which grow quickly under moist conditions. Also, wet foliage can spread disease.

F. Adaptable - A drip irrigation system can be modified easily to adjust to the changing needs of a garden or lawn.

G. Use of Sensors- The working of above project is basically dependent on humidity sensors which will be possible by using sensor technology and use of PH sensors.

V. CONCLUSION

Thesystemprovideswithseveralbenefitsandcanoperatewithless manpower.Thesystemsupplieswateronlywhen the humidity in the soilgoesbelow the

reference.Duetothedirecttransferofwatertotherootswaterconservationtakesplaceandalsohelpstomaintainthemoisturetosoilratioattherootzoneconstanttosomeextent.Thusthesystemisefficientandcompatible tochangingenvironment.

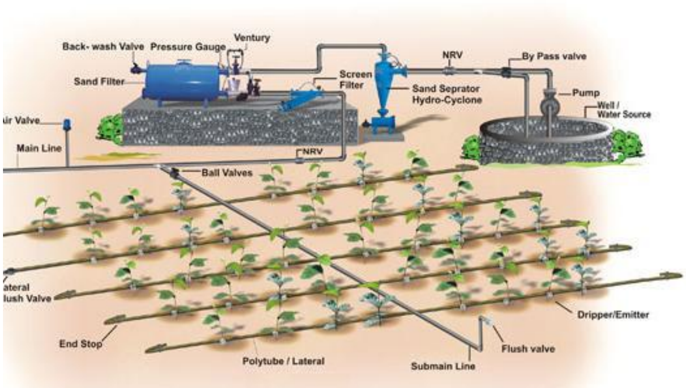

Fig.2

REFERENCES:

[1] Clemens, A.J. 1990.Feedback Control for Surface Irrigation Management *in*: Visions of the Future. ASAE Publication 04-90. American Society of Agricultural Engineers, St. Joseph, Michigan, pp. 255-260.

[2] Fang Meier, D.D., Garrote, D.J., Mansion, F. and S.H. Human. 1990. Automated Irrigation Systems Using Plant and Soil Sensors. *In*: Visions of the Future. ASAE Publication 04-90. American Society of Agricultural Engineers,St. Joseph, Michigan, pp. 533-537.

[3] Muhammad Ali Mazidi and Janice Gillispe Mazidi, "*The8051microcontrollerandembeddedsystems*", Pearson education ltd., India, 2007.

[4] National semiconductor corporation, ADC 0809 data sheet, 8-bit Microprocessor compatible A/D converters with 8- channel multiplexer, national Semiconductor data book,October 2002 updates.

[5] Introduction to LCD programming tutorial by Craig Steiner Copyright 1997 - 2005 by Vault information services LLC.

[6] H S kalsi, "*Electronicinstrumentation*", Tata McGraw-Hill Ltd., New Delhi, 1999