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Embedded System Based Remotely Operated Smart Irrigation System Using PIC18F4550 Microcontroller

Karthick.C[1], Prabhakaran.D[2]
[1] *Department of ECE,* [2] *Department of Mechatronics, Mahendra Engineering College, Namakkal DT, TamilNadu, India.*

Abstract: ***Modern Irrigation system is defined as artificial application of water to land or soil. The Irrigation process can be used for the cultivation of agricultural crops inadequate rainfall and for maintaining landscapes. The embedded based automatic irrigation system is the operation of a system without need of manual involvement of humans. Every irrigation system equipments such as drip, sprinkler gets automated with the help of electronic devices and detectors such as computer, timers, sensors and other hardware devices. For the precisely monitoring and controlling of the agriculture filed, different types of sensors were used. To implement the proposed system PIC18F4550 Microcontroller is used. The irrigation system is monitored and controlled more efficiently by the proposed scheme. In this system GSM technology is used to inform the user about the field condition continuously. Truly this method of irrigation system has been proposed primarily to save the resources, yield of crops and farm profitability. The PIC18F4550 micro controller connected with GSM module works as a main part and temperature sensors, level sensors and rain sensors works as eyes of the project. The power monitoring circuit and battery backup unit take this ESD to next level by inform the presence of 3- phase power supply in the field. The farmer only needs to send programmed commands through SMS from her mobile phone to this unit to carry out irrigation process more quickly. if eyes of the system device watches all parameters are within a control range, the PIC18F4550 microcontroller starts irrigation process by starting the irrigation pump. The farmer gets time to time feedback from ESD through SMS about the action that taken place by PIC18F4550 microcontroller. The GSM unit allows farmers to handle and monitor a remotely placed pump from anywhere far from their field. Then the free SMS facilities provided to farmers makes it more cost savings. In this way, this new engineering technology makes farmers life easier by providing remotely operated, more efficient and cost effective irrigation system.***

Keywords: Irrigation; GSM; PIC microcontroller; Cost effective; Indian Economy.

I. INTRODUCTION

India is an agricultural country. Lot of new technologies are emerging in the field of agriculture to raise its productivity. But, still there are some ailments in the present agriculture scheme. Few of them are listed below

Fig 1.Automatic irrigation system

An modern automatic irrigation system does the work more efficiently and with a positive impact on the place where that is installed. Once it is installed in the agricultural field, the water distribution of the field and nurseries are very easy and doesn't need

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any human work support to perform the operations permanently. Normally automatic irrigation also be performed by using mechanical devices such as clay pots, bottle irrigation system. It is very hard to implement irrigation systems why means its very costly and complexity of its design. So we need some projects on automatic irrigation system by using different modern technologies. In this project, we describe about 3 types of irrigation systems that work automatically without human support and each system is an advancement of the previous one as we go from first system to the next, and so on. The modern automatic irrigation system is sense the soil moisture project is intended for the development of an irrigation system it switches submersible pumps on or off by using relays to perform the action on sensing the moisture content of soil. The advantage of using this system is to reduce the human workload and ensure proper irrigation.ThePIC18F4550 Microcontroller work as a main block of the whole project, and a power supply unit is used to supply 5V 5 volt power to the whole circuit with help of transformer, a rectifier circuit and a voltage regulator. The PIC18F4550 microcontroller is programmed that it receives the input signal from the sensing material like sensors which consists of a comparator to know the varying conditions of the moisture in the soil. The Operational Amplifier which is used as comparator acts as an interface between the sensing material and the microcontroller for transferring the moisture conditions of the soil, wetness, dryness, and field conditions. The required connections from these metallic rods are connected to control unit for control the operations of the pump. This modern automatic irrigation system can be further enhanced by using modern technology that consumes solar energy from solar panels.

II. PROPOSED SYSTEM

The most of farmers make use of irrigation pump method which demands electric power to irrigate the fields. But farmers are facing load shedding is one of the major problem. So the farmers need to visit the field of monitoring, operating the irrigation pump system. This leads to waste his time if there is no current supply in the irrigation field. The modern engineering solution farmer can monitor and operate a remotely placed irrigation pump with just a message from his cellular phone thereby reducing waste of time. The overall block diagram of proposed scheme is shown in figure 1.

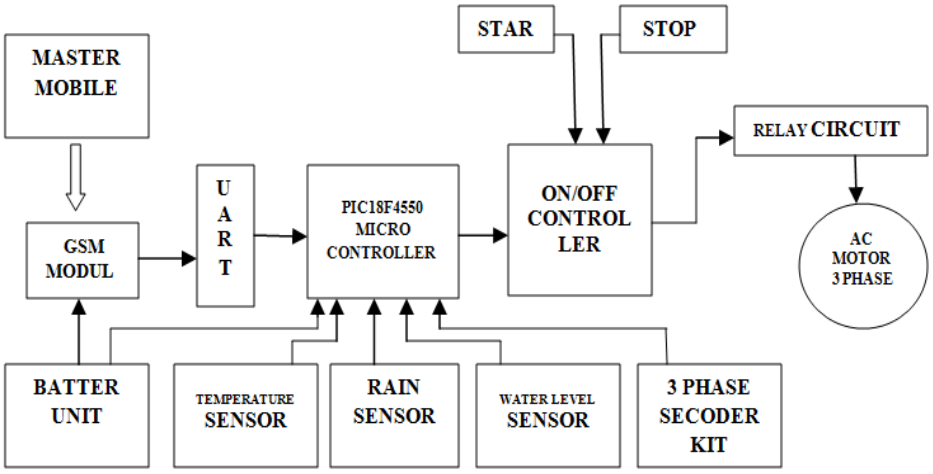

Fig. 2 Block diagram of proposed system

A. *GSM module*

GSM is Global System for Mobile Communications was developed by the European Telecommunications Standards Institute (ETSI)As of 2014, it has become the global standard for mobile communications with over 90% market share, operating in over 219 countries .2G networks are developed as a replacement first generation 1G analog cellular networks and the GSM standard originally described as a digital, circuit-switched network optimized for full duplex voice telephony. The 3GPP developed third-generation (3G) UMTS standards, followed by fourth-generation (4G) LTE Advanced standards, which do not form part of the ETSI GSM standard."GSM" is a trademark owned by the GSM Association. It may also refer to the (initially) most common voice codec used, Full Rate.

B. *Soil Moisture Sensor Module*

The soil moisture sensor is used to find the volumetric water content of soil in the irrigation field. The Soil Moisture Sensors used in the system is shown below. It consists of two prongs, which must be inserted in the soil, an LM358, which used as a

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comparator..The circuit shown below has a fixed sensitivity. This can be changed by implementing a pot in place of one of the resistors connected to the non-inverting terminal of the comparator.

Fig. 3 Soil Moisture Sensor Module

C. Microcontroller unit

Fig.4 PIC18F4550 microcontroller

PIC18F4550 is a 8-bit microcontroller in PIC18 family. PIC18F family is based on sixteen bit instruction set. This microcontroller consists of 32 KB f memory, 2 KB SRAM, 256 Bytes EEPROM. It is a 40 pin PIC Microcontroller containing of 5 five input &output ports. The other ports have different numbers of pins for I/O data communications. PIC18F4550 work on different internal and external clock sources. It operating frequency range is from 31 KHz to 48 MHz. It has four in-built timers. Is this microcontroller is equipped with enhanced communication protocols like EUSART, SPI, I2C, USB etc. It works irrigation pump in accordance with received decoded commands from GSM module and signals from all sensors. The relay is connected between microcontroller and irrigation pump unit.

D. Rain Sensors module

Fig. 5 RainSensor Module

A rain sensor is a switching device activated by when rainfall is come. The two main applications for rain sensor is first a water conservation device connected with automatic irrigation system that alert the system to shut down in the event of rainfall. The second is a device used to protect the inner block of an automobile from rain and to support the automatic mode of windscreen wipers. The other application in satellite communications antennas is to trigger a rain blower device on the aperture of the antenna feed, to remove water droplets from the Mylar cover.

E. Temperature Sensor LM35 module

The Temperature Sensor is used to monitor the motor winding temperature. This is a precision integrated-circuit temperature sensor. Its output voltage is proportional to the Centigrade temperature. It is an advantage over linear temperature sensors calibrated

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in Kelvin. The LM35 provides accuracies of C at room temperature and C over a full 55C to +150C temperature. The precise calibration, linear output and low output impedance of LM35 makes interfacing with PIC18F4550 very easy. The very low cost and very low self-heating effect of less than 0.1C in still air makes LM35 more significant .This LM35 is placed closely to motor winding it sense temperature. It produces the output voltage of the motor winding temperature. Inbuilt Anolog to Digital Converters of PIC18F4550 converts this analog signal of LM35 to digital form and monitor motor winding temperature continuously.

F. Water level detector sensor module

To Implement the conductivity principle of water, PIC18F4550 microcontroller have build in functions as water level detector. Two pins of the PIC18F4550 microcontroller is used for sensing water level. One pin as an output and another pin as an input to the PIC18F4550 microcontroller. The PIC18F4550 microcontroller is then programmed in such a way that an output pin remains high for all time and input pin waits for high signal. Suppose water is sufficient in the reservoir, two pins are come in contact with each other and hence input pin senses the high signal. Once the input pin senses the high signal microcontroller can start the irrigation pump provided that all other parameters are in safe limit.

In the overall proposed system works above steps the farmer sends command through his mobile using Smart Message Service from his mobile phone to GSM module. Then the farmer gets the message of delivery report from network service providers on delivering SMS to Global System Monitoring (GSM) module. The GSM module then converts the received command then sends it to the PIC18F4550 microcontroller. The Microcontroller authenticates the received mobile number. Suppose the authentication fails microcontroller ignores that command. If authentication result is success then the microcontroller checks all the parameters vice versa. Suppose all of the parameters in a safe limit, then it starts the motor and send a SMS to farmer as motor start now. Then starting motor and microcontroller unit continually check all parameters. Suppose any one of the parameter down to below safe limit, the microcontroller switch off the motor and deliver SMS to the farmer as motor stop now with reason as power supply proplem, its raining or excess winding temperature. So overall the system is very useful to the formers and the modern agricultural fields.

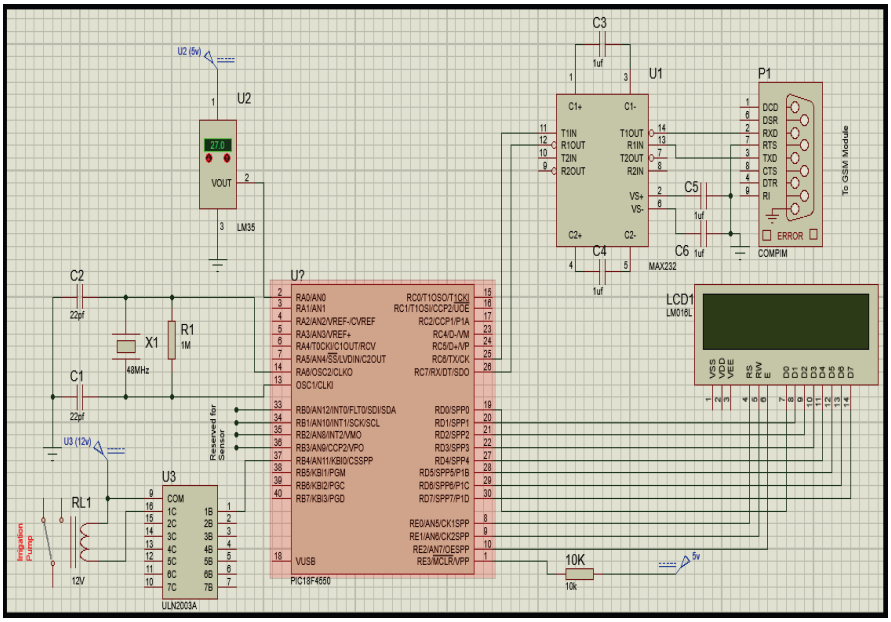

Fig.6Proteus Simulation of PIC18F4550 microcontroller

III. CONCULSION

proposed system informed irrigation process in a smart way for agriculture. That system assures to get protection of motor against fluctuating power supply, dry dun state and overheating of motor winding. The Remote operation of pump, feedback facility to know status of pump and field parameters, remote authentication facility to avoid unauthorized operation, uniform distribution of water, prevention of wastewater and electricity are the advantage of this system. This system is very useful to farmers who need irrigation pumps are placed far long away from their home. The Working procedure of PIC18F4550microcontroller as the water level sensor and rain level detector sensor reduces the need for separate sensors. Built in Analog to Digital Converters of the

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microcontroller also reduces need for a external hardware circuitry. The proposed system is a real time feedback control system which monitors and controls the irrigation system activities efficiently and the so the proposed system is very low cost and improves agriculture productivity.

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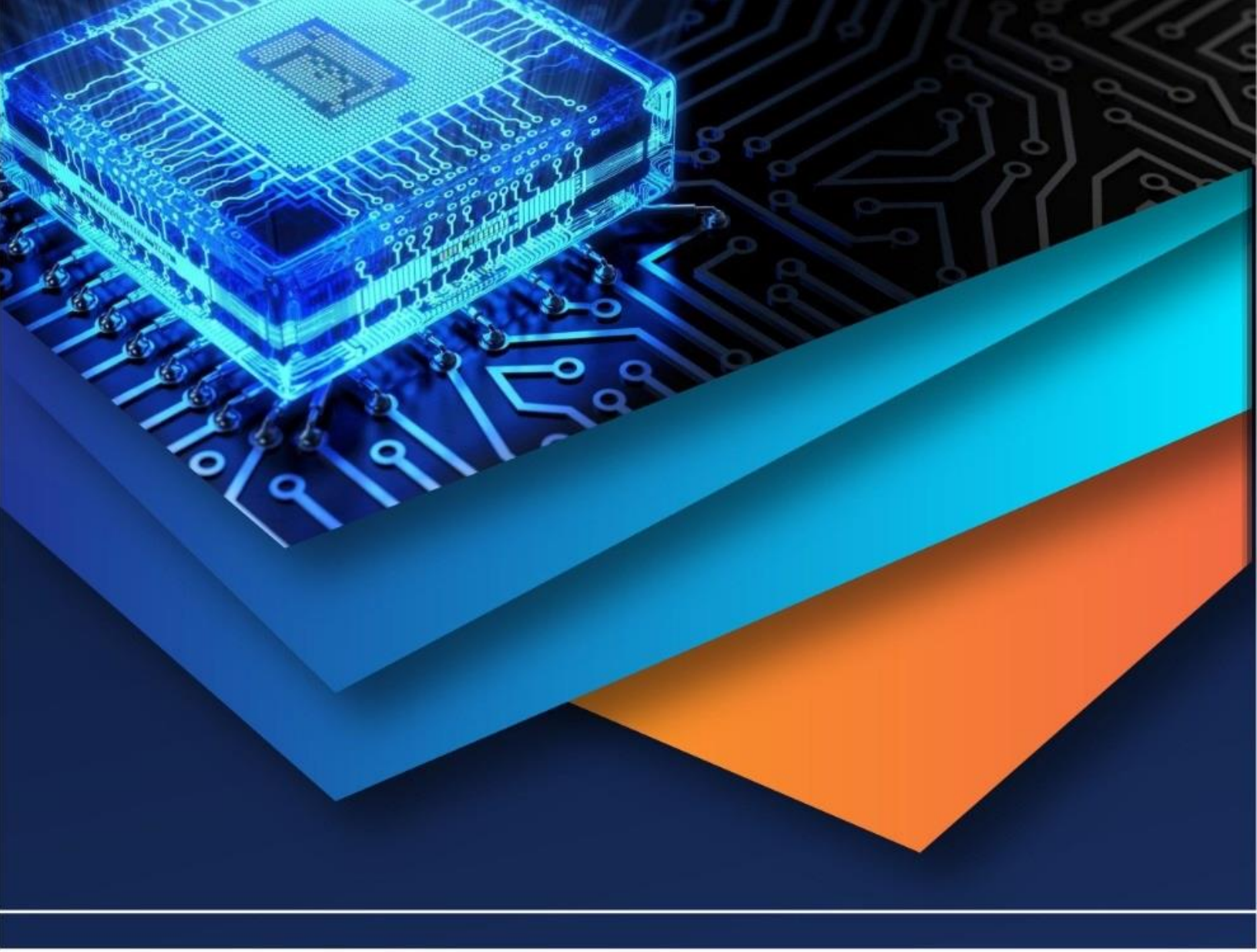

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