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Research Paper

WIRELESS BASED SERVICE TO MONITOR AUTOMATIC IRRIGATION SYSTEM FOR AGRICULTURE FIELD

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Alternative energy technologies, like solar based energy generation systems, are receiving national and worldwide attention owing to the rising rate of consumption of nuclear and fossil fuels. In particular, drivers for solar renewable energy systems are the environmental benefits (reduction of carbon emissions due to the use of renewable energy sources and the efficient use of fossil fuels), reduced investment risk, fuel diversification, and energy autonomy, increased energy efficiency (less line losses) as well as potential increase of power quality and reliability and in certain cases, potential grid expansion deferral due to the possibility of generation close to demand. Therefore, solar power has been used for recharging of the battery for driving the pump. Wireless sensors has been established in filed to record the field status through the PIC microcontroller wireless technology like GPRS techniques has been used for the informing the user about the field parameters which avoid the problem of physical monitoring services of the field. A relay which is an electronic switch is used for switching the operational mode of the pump.

Keywords: Solar energy, GPRS module, Wireless sensors, PIC microcontroller, Realy switch

INTRODUCTION

Renewable source of energy are gaining attention nowdays. So its use in the monitoring of the agriculture field is also driving attention. Previously, parameters of the agriculture field are handled manually by the farmers. No automatic technique was available which lead to the wastage of water during irrigation sometimes. The wired lines used to established which create difficulty for monitoring during night or when power is switched off. A new system to check the agriculture field parameter automatically is designed using wireless sensors which is

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charged by a group of photovoltaic cells, i.e., solar power. A threshold value is set for the sensors and if the value goes beyond the threshold value, the status will be updated to the farmer through GPRS module, i.e., GSM by sending the text messages to the farmer (Chandrika Chanda and Surbhi Agarwal, 2012). For transmitting the data between system and the user, microcontroller is interfaced with GSM. It has sim storage capacity which store the control instructions and status of the field (Godfrey Mills, 2013). The operational mode of the water pump is control by the relay which is an electronically operated switch. The statuse are displayed by the LCD.

OVERVIEW OF THE SYSTEM

An irrigation system uses PIC16F877a microcontroller, the other parts of the hardware system are power supply, sensors, pump switching system, GSM communication module. A communication module transfer the data between the user and system. The logic of the operation for the controlling of the irrigation system is implemented on microcontroller (Deepti Bansal, 2013).

The sensors like temperature sensor, water level sensor, humidity sensor is being used. The series of LM34 sensors is used as temperature sensors in which external calibrations not required and its output value is proportional to the Fahrenheit value. The series of aqua plumb water level sensors is being used which is used to measure the water level of the tank, reservoir, etc.

To transmit the data between microcontroller and GSM module MAX232 is used which convert the voltage level. Message

Figure 1: Block Diagram of the Controller System

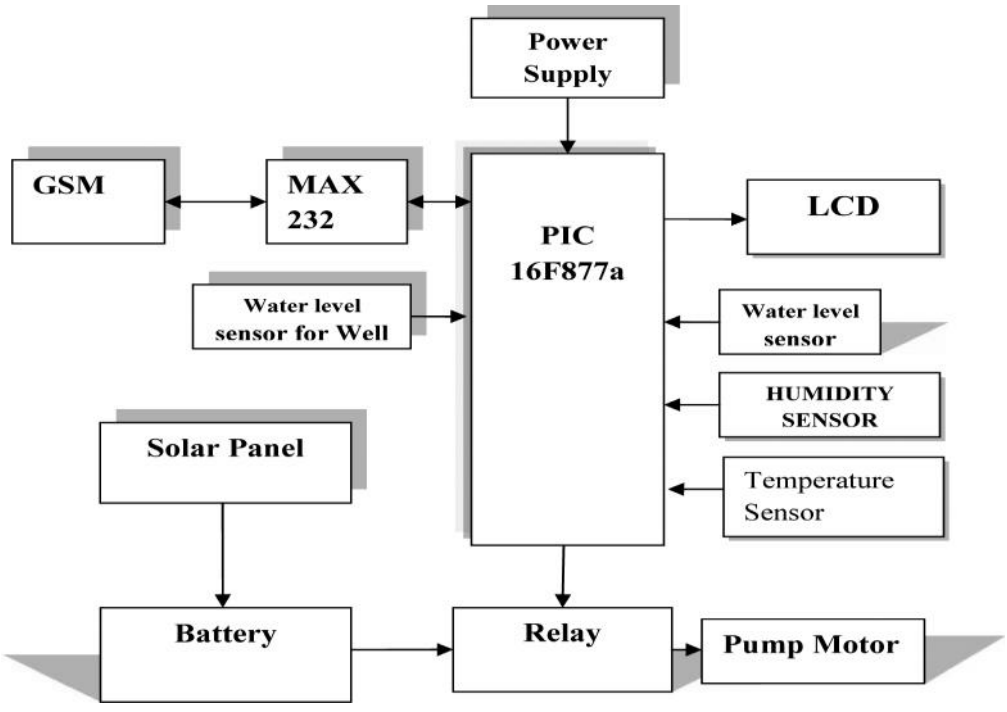
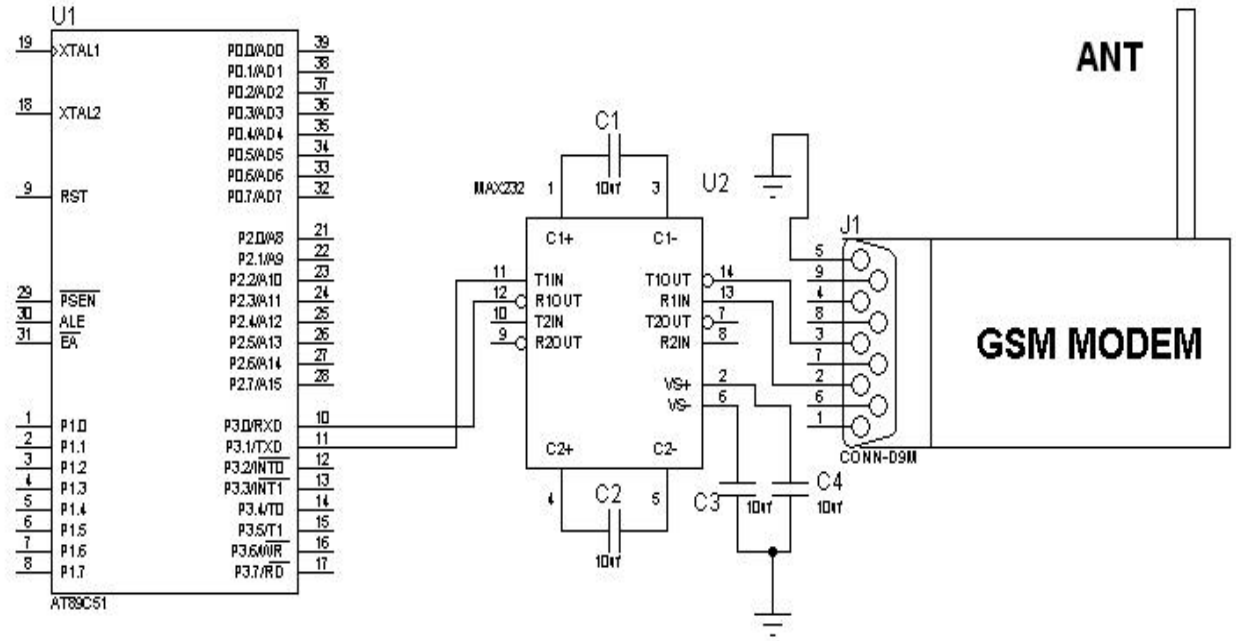


Figure 2: Circuit Diagram of GSM Based Irrigation and Controller System



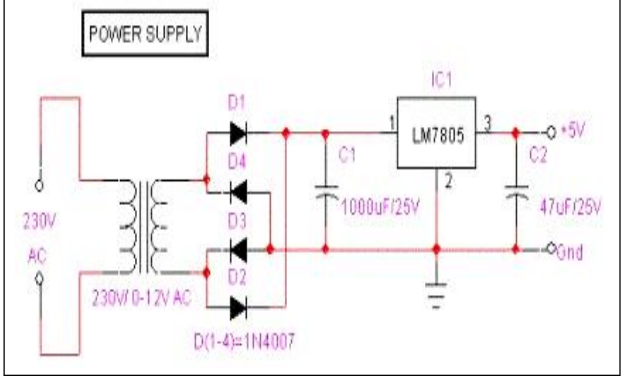
will be transmitted to the monitoring section via GSM modem. The messages from the microcontroller is transfer using USART. The most current data is transferred to sim card storage system every 60 minutes and those current data are access by the users (Stephen Armoo *et al.*, 2013). A relay which is a electronic operated switch is also used to control the operational mode of the pump.

RESULTS AND DISCUSSION

Power Supply Unit

This section describes how to generate +5V DC supply. The primary of this transformer is connected in to main supply through on/off switch and fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5V, by using IC 7805.

Figure 3: Power Supply Unit



PIC Microcontroller

High-Performance RISC CPU

- Operating speed: 20 MHz, 200 ns instruction cycle
- Operating voltage: 4.0-5.5V
- Industrial temperature range (–40° to +85 °C)
- 15 Interrupt Sources

- 35 single-word instructions
- All single-cycle instructions except for program branches (two-cycle)

Special Microcontroller Features

- Flash Memory: 14.3 Kbytes (8192 words)
- Data SRAM: 368 bytes
- Data EEPROM: 256 bytes
- Self-reprogrammable under software control
- In-Circuit Serial Programming via two pins (5V)
- Watchdog Timer with on-chip RC oscillator
- Programmable code protection
- Power-saving Sleep mode
- Selectable oscillator options
- In-Circuit Debug via two pins

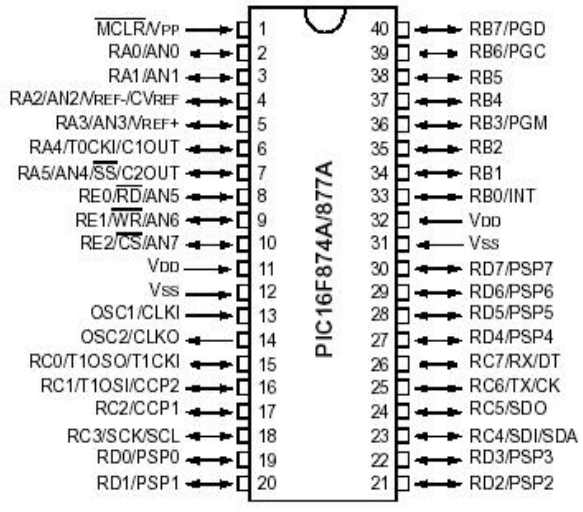
Peripheral Features

- 33 I/O pins; 5 I/O ports
- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler
  - Can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
  - 16-bit Capture input; max resolution 12.5 ns
  - 16-bit Compare; max resolution 200 ns
  - 10-bit PWM
- Synchronous Serial Port with two modes:
  - SPI Master
  - I2C Master and Slave
- USART/SCI with 9-bit address detection
- Parallel Slave Port (PSP)
  - 8 bits wide with external RD, WR and CS controls
- Brown-out detection circuitry for Brown-Out Reset

Analog Features

- 10-bit, 8-channel A/D Converter
- Brown-Out Reset
- Analog Comparator module
  - 2 analog comparators
  - Programmable on-chip voltage reference module
  - Programmable input multiplexing from device inputs and internal VREF
  - Comparator outputs are externally accessible

Figure 4: PIN Diagram



Memory of the PIC16F877 Divided into 3 Types of Memories

- Program Memory—A memory that contains the program(which we had written), after we've burned it. As a reminder, Program Counter executes commands stored in the program memory, one after the other.
- Data Memory—This is RAM memory type, which contains a special registers like SFR (Special Faction Register) and GPR (General Purpose Register). The variables that we store in the Data Memory during the program are deleted after we turn of the micro.

  These two memories have separated data buses, which makes the access to each one of them very easy.
- Data EEPROM (Electrically Erasable Programmable Read-Only Memory)—A memory that allows storing the variables as a result of burning the written program.

Each one of them has a different role. Program Memory and Data Memory two memories that are needed to build a program, and Data EEPROM is used to save data after the microcontroller is turn off.

Program Memory and Data EEPROM they are non-volatile memories, which store the information even after the power is turn off. These memories called Flash Or EEPROM. In contrast, Data Memory does not save the information because it needs power in order to maintain the information stored in the chip.

GSM MODEM

A GSM modem is a wireless modem that works with a GSM wireless network. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. The working of GSM modem is based on commands, the commands always start with AT (which means Attention) and finish with a <CR> character. For example, the dialing command is ATD<number>; ATD3314629080; here the dialing command ends with semicolon.

The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with the controller with the help of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal based on RS 232 levels.

TEMEPRATURE SENSORS

A series of LM34 sensors is being used as a temperature sensors. It is a precision integrated circuit temperature in which external calibration is not required. The output voltage is proportional to the Fahrenheit value.

Figure 5: Circuit Diagram for the LM34 Temperature Sensor Functional Module

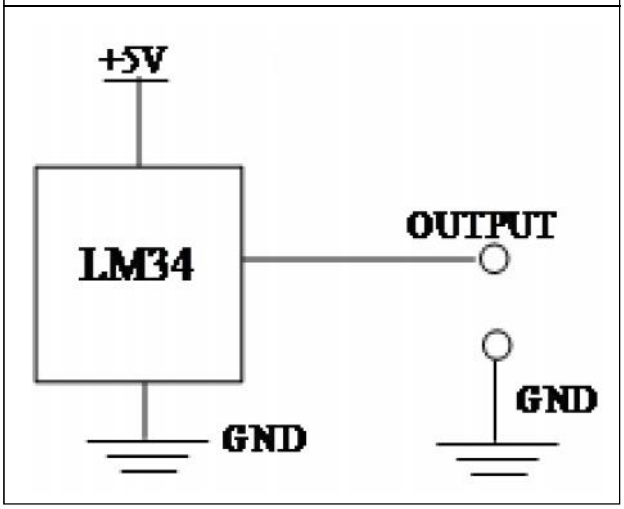
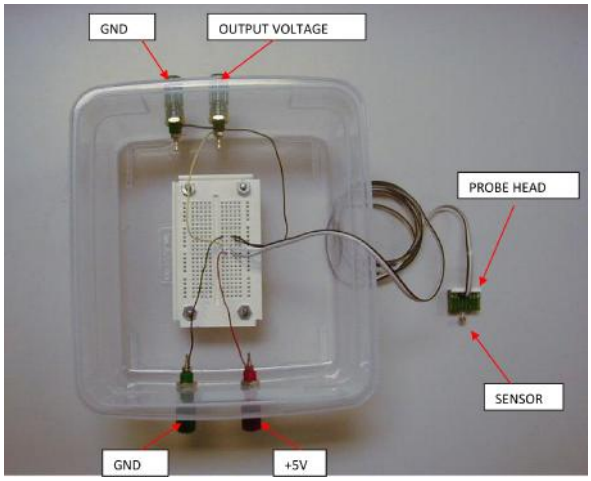


Figure 6: Labeled Picture of the Temperature Sensor Circuit Functional Module



WATER LEVEL SENSORS

A series of aqua plumb is being used as water level sensors. The reading is reported back as a analog voltage ranging from 0V to 3V where 0V indicate the sensor not being submerged while 3V indicate the maximum liquid level. The normal power mode for the operation is 1.2 mA, so this system can be loop powered in 4-20 mA current loops. During calibration mode the sensor consumes up to 20 mA, but this is only used during calibration for the initial setup.

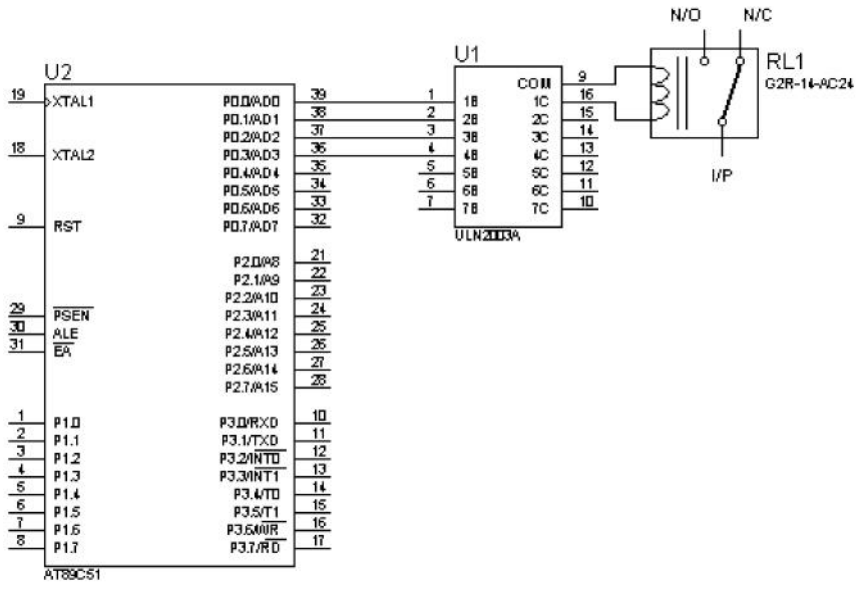
RELAY

An electronic operated switch. Electric current through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and there are double-throw (changeover) switches. The P0_0, P0_1, P0_2 and P0_3 pin of controller is assumed as data transmit pins to the relay through relay driver ULN 2003. ULN 2003 is just like a current driver.

LCD

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this, we will discuss about

Figure 7: A Relay in PIN Diagram



character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming.

SOLAR PANEL

Solar in the form of solar electric panel, also known as photovoltaic modules (or PV modules), convert sunlight into electricity. The solar energy is used to reduce the power consumption of the battery and introduce the environmental friendly technique.

CONCLUSION

The technique of monitoring the irrigation of the agriculture field through automation is found to be cost effective, fast response , saves energy and time. It reduces the wastage of water resources during irrigation and also in some areas provide sustainable use of water where the shortage of water occurs. The use of solar power in the irrigation reduces the consumption of electric power which can be expensive. The intimation of the status of field parameter to the user through GSM lessen the difficulty of the farmer for the manually handling of field. Therefore, this kind of irrigation system is used for contracting the wastage of the resources.

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