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GSM BASED RAIN FALL DETECTOR USING ARDUINO

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ABSTRACT

The climate change is one of the most important factors affecting the quality of life and the activity of the increasingly population. A sensor is a device that converts one type of energy to another. Arduino is a small microcontroller board with a USB plug to connect to the computer. The Arduino board senses the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lcds, speakers, motors and GSM module.

The rain sensor module with LM393 is used for measured for rain fall measurement. The rain sensor module is interfaced with an Arduino. The Arduino interfaced with LabVIEW software with LIFA tools. The real-time measuring results are transferred as text message to specified mobile number, software are used to predict the rain level of flood locations. GSM SIM900 Modem is interfaced to Arduino for text messaging.

KEYWORDS: ATmega328, LM393, LIFA, GSM SIM900

INTRODUCTION

A sensor is a device that converts one type of energy to another. This may include physical, biological, chemical, electrical, or optical energy. Signals received by the sensor are in the analog form, and can be digitally formatted and processed by computers. Embedded systems are utilized to connect PCs for data transfer. The climate change is one of the most important factors affecting the quality of life and the activity of the increasingly population.

The present work is for sensing the water level of the rain using rain sensor and it alarm and send text message to specified person after a predetermine time. This is a low cost simple experiment using Arduino.

Arduino [1] microcontroller board is connected to the computer and a number of connection sockets that can be wired up to external electronics, such as motors, relays, light sensors, laser diodes, loudspeakers, microphones, etc. They can either be powered through the USB connection from the computer or from a 9V battery. They can be controlled or programmed from the computer and then disconnected and allowed to work independently. Arduino Uno, a microcontroller board based on the ATmega328 is used in this work. The hardware consists of a simple open hardware design for the Arduino board with an on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the arduino board.

The Arduino board senses the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lcds, speakers, motors and GSM module. The open-source Arduino environment makes it easy to write the code and upload it to the I/O board. It runs on Windows, Mac OS X, and Linux.

For rain water level measurement, LabVIEW software from National Instruments is used, the front panel, which

monitor and controls the output signal. The Arduino interfaced with LabVIEW software has been interfaced with rain sensor using LIFA tools. The measured results are transferred using sensor network based on GSM SIM900 modem and the software are used to predict the rain level of flood locations.

HARDWARE

Block Diagram

The Block diagram of Rain fall Detector with Arduino is as shown in figure 1.

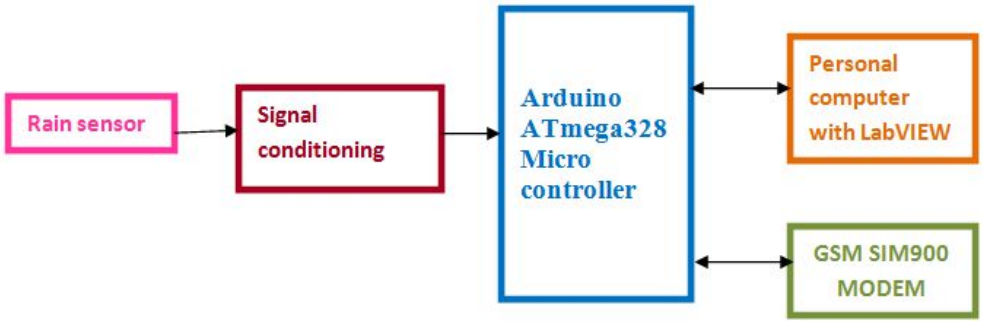

Figure 1: Block Diagram of Rain Fall Detector with Arduino

In this paper, water level of the rain is measured through suitable sensor and the sensor outputs are connected to a main routine of VI. The hardware components the system as explain below

- The Rain fall sensor module
- Arduino-ATmega 328 Microcontroller
- Personal computer with LabVIEW
- GSM SIM900 MODEM

1. The Rain Fall Sensor Module

The rain sensor module is used for measured for rain level measurement. The rain sensor module consists of the LM393 for signal conditioning. The rain sensor module is interfaced with an Arduino. The LM393 chip-based rain sensor works on 5volts. The module has two indicators, which are Power indicator and Output indicator LEDs. The module has User Control with Onboard sensitivity adjustment potentiometer. The output of the module will provide both Digital output (DO) & Analog output (AO) simultaneously. In present work we are using analog output for further processing. The analog output (AO) of the rain fall sensor module is connected to one analog input (A0) of the Arduino, so that the microcontroller can read an analog voltage between 0 and 5 volts to process a number between 0 and 1023, where 0 representing 0 volt, and 1023 representing 5 volt.

If the rain sensor plate of the rain sensor module is in dry state, analog output (AO) from the module is 5V. During rain, the sensor plate elements are bridged by the rain water and hence this analog output gradually changes from 5V to 0V, based on the moisture level between the sensor pads. In this way, the sensor reports the absence and presence of the rain in an analog way help us to determine whether the rain is light or strong by analyzing the outputted analog signal. The rain sensor module with sensor is as shown in figure 2.

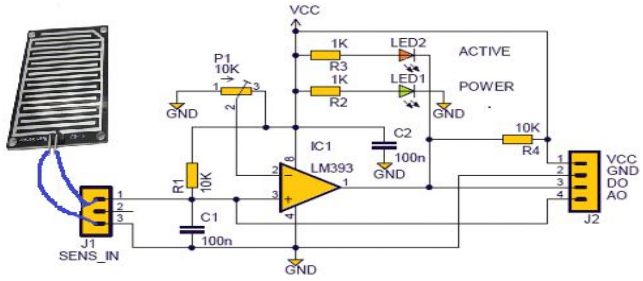

Figure 2: The Rain Sensor Module

2. Arduino - Atmega328 Microcontroller

The Arduino [2] Uno is an open-source microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs) and 6 analog input. It contains everything needed to support the microcontroller, and it can be simply connected to a computer with a Universal Serial Bus (USB) cable to get started.

The Arduino Uno can be programmed with the Arduino Integrated Development Environment (IDE). The C-based simple program code for the Arduino is referred to as a sketch. Collection of sketches for specific functionalities is referred to as libraries. The Arduino can be programmed upto 32 KB memory. Arduino can function autonomously without being connected to a computer, or alternatively programmed to respond mainly to commands sent from the computer via various software interfaces or to the data acquired from the input channels. The Arduino UNO based on ATMega-328 Microcontroller is as shown in figure 3.

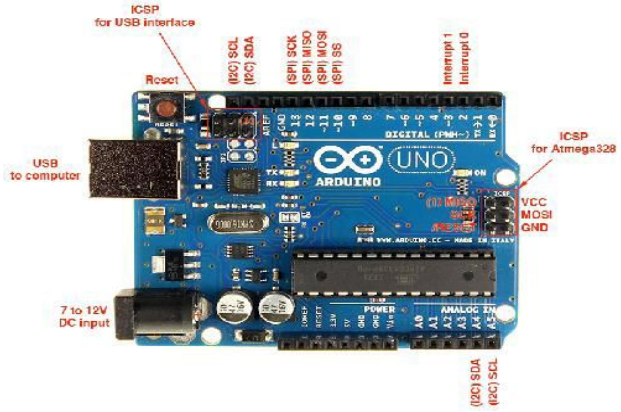

Figure 3: Arduino UNO Based on ATMega-328 Microcontroller

The hardware functionality of Arduino can be extended with external plug-ins, some of them are for example adding networking capabilities such as Ethernet, Bluetooth, ZigBee, TFT touch panel capability, data logging capability without the need of a computer joystick and button combination for reading user input motor drive shields and specific shields with LED drivers included for LED control. In practice, the Ethernet shield gives the Arduino an IP address allowing it to be controlled over the internet, the Bluetooth shield allows wireless communication with mobile phones running on Android and iOS/iPhone, and the ZigBee shield interaction with wireless sensor networks for example.

The approximation is handled by a simple Arduino sketch. An additional function is delaying of the alert

generation; Arduino raises an alert only when raining with a certain threshold is detected, within a pre-defined time interval. This extra feature helps in reducing false alarm counts to some extent. The present work is for switching an acoustic sounder as a rain alarm and sending text message to a specified person. The analog output read from the sensor module is transferred to personal computer through serial port via Arduino. The result transmitted from the Arduino is accessed through LabVIEW. The LIFA tools are used for acquiring Arduino through LabVIEW. If the results are in the predefined range, it only transmits and display values in the monitor. If it is out of range, a text message will be transmitted to the mobile which we assign in the sketch.

3. Personal Computer with LabVIEW

LabVIEW (short for Laboratory Virtual Instrument Engineering Workbench) is a system-design platform and development environment for a visual programming language from National Instruments. The graphical language is named "G". Originally released for the Apple Macintosh in 1986, LabVIEW [3] is commonly used for data acquisition, instrument control, and industrial automation on a variety of platforms including Microsoft Windows, various versions of UNIX, Linux, and Mac OS X. LabVIEW [4] programs are called virtual instruments, or VIs. LabVIEW contains a comprehensive set of tools for acquiring, analyzing, displaying, and storing data, as well as tools to help in troubleshoot. The proposed system has a VI which is capable of processing the data coming from the arduino through sensor module and shows it graphically through meters, and graphs. To configure and install the application has been made very easy to understand.

LabVIEW Interface for Arduino (LIFA)

The NI LIFA toolkit helps us to interface LabVIEW software with Arduino microcontroller. With LIFA we can acquire or control data from the Arduino microcontroller. Once the information is in LabVIEW, analyze it using the hundreds of built-in LabVIEW libraries; develop algorithms to control the Arduino hardware.

A sketch for the Arduino microcontroller acts as an I/O engine that interfaces with LabVIEW VI's through a serial connection. This helps to transmit information from Arduino pins to LabVIEW. Using the common Open, Read/Write, and Close convention in LabVIEW, we can access the digital, analog, pulse-width modulated, I2C, and SPI signals of the Arduino microcontroller. Some of the advantageous of LIFA are

- Interact with your system through a graphical user interface.
- Streamline your design process with intuitive graphical programming.
- Improve your debugging experience with interactive tools.
- Leverage built in resources/functions for implementing simple to complex tasks.
- Open API (Application Programming Interface) allows for complete customization.

4. Global System for Mobile Communications - SIM 900

Group Special Mobile (GSM) is the world's most popular standard for mobile telephony systems. The GSM Association estimates that 80% of the global mobile market uses the standard. GSM is used by over 1.5 billion people across more than 212 countries and territories. This ubiquity means that subscribers can use their phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM is pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other

mobile phone standards as well. The standard includes a worldwide emergency telephone number feature.

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator. In modem we can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. This GSM modem is a highly flexible plug and play quad band SIM900D GSM modem for direct and easy integration to RS232 applications.

GSM Modem SIM900 has Highly Reliable for 24x7 operations with Matched Antenna, Status of Modem Indicated by LED, Simple to Use & Low Cost; Quad Band Modem supports all GSM operator SIM cards. Some of the Applications are SMS based Remote Control & Alerts, Security Applications, Sensor Monitoring, GPRS Mode Remote Data Logging.

The communication protocols with a GSM system are used to transmit alarm messages and signals on demand. The monitoring system is integrated with a GSM modulation tool which is prompted on the activation of any alarm. The GSM module communicates to the server, the string message generated. The string is then sent to the destination address. Systems to show error on disconnect or network unavailability problem is also built. GSM MODEM- SIM900 is as shown in Figure. 4

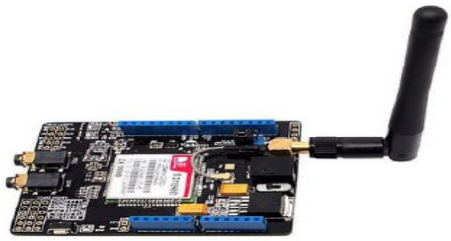

Figure 4: GSM MODEM- SIM900

SOFTWARE

The software programs of the GSM based Rain Fall Detector using Arduino are write in labview and Ardunio IDE. The labview program front panel and block diagram is as shown in figure 5, 6.

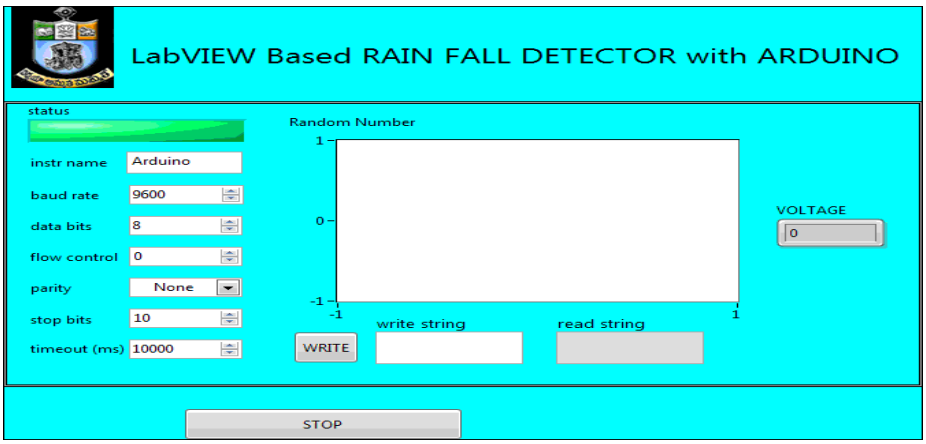

Figure 5: Front Panel of LabVIEW Based Rain Fall Detector with Arduino

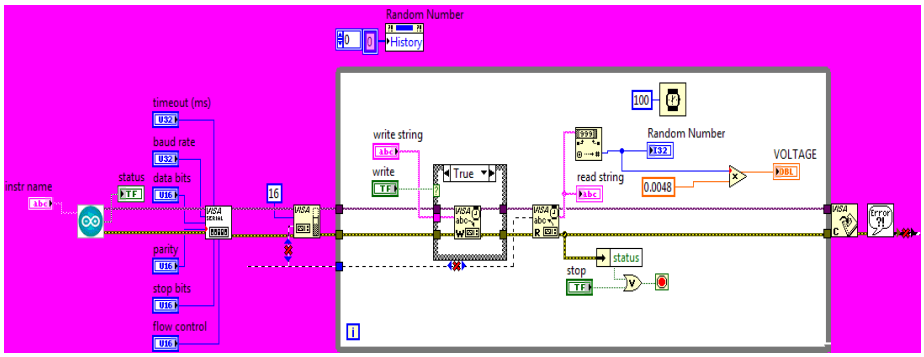

Figure 6: Block Diagram of LabVIEW based Rain Fall Detector with Arduino

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