

Development of A Data Acquisition And Greenhouse Control System

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Abstract - *This project explains the design and implementation of electronic system based on GSM (Global System for Mobile communication) for controlling the climate parameters by SMS (Short Message Service) in greenhouse. The main purpose of this system conception is the remote control of the climatic parameters that influence the production in greenhouse (Temperature, relative humidity of air, light and soil moisture). Several sensors and actuators are installed and interconnected to a management and acquisition card. These sensors provide relevant information that is used to control ventilation, heating and pump by SMS. The procedure used in our system provides the owner with a remote control avoiding the need to perform the control actions on site. The proposed system is ideally suited for agricultural greenhouses. It is simple to be installed and used by farmers who do not computer skills. Besides, most people use their cellular phones to communicate and send messages. Thus, a prototype is developed with a simple message where all farmers can control their greenhouses from a distance by knowing the status of their greenhouse climate at any time (temperature, humidity...) and can control actuators to adjust these parameters (fan, heater, vent, drip irrigation...).*

Keywords — Sensors, Greenhouse, Microcontroller, GSM, Control, Monitoring

I.Introduction

The research in the agriculture field of Microsystems is progressively directed towards smart electronic interfacing, which provides the ability of performing complex operations. Specially designed interfacing electronics for specific applications improve the performances of the Microsystems and provide a user-friendly environment for the control and the communication with it. Data acquisition system is extensively employed in a number of automatic test and measuring equipments. They are used to collect the required data from any peripheral input devices, such as meters, sensors and etc. via controlling program. The data acquisition system presented makes use of two analogue inputs out of which one can be used for sensing the temperature and the other can be

used for sensing the humidity .The system can easily be adopted for additional analogue inputs. The microcontroller based data acquisition and control unit with two analogue inputs and keeps on controlling of temperature, humidity and water level of soil as per the crop requirement. This system uses AVR microcontroller ATmega16. The inbuilt ADC receives analog data from sensors and converts it to digital data and passes it to the microcontroller. The sensors continuously sends data from the distant site, interfaced with a GSM modem. System senses the conditions continuously and message is sent to mobile using SMS and also displays on LCD in interval every 10 minutes. Using this system, the operator can monitor the signals from anywhere. The GSM modem is connected to microcontroller using RS232 interface. Whenever an SMS is sent to the GSM modem, the GSM modem receives the data and sends to microcontroller. After receiving the signal from the microcontroller it processes the data and sends the read data to mobile number through GSM modem. The collected data is formed a database and stored in a pc. The received data is displayed on the LCD. 16X 2 LCD is provided for user interface.

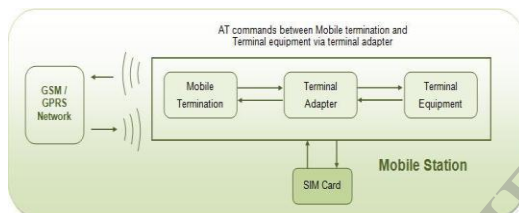
II.System overview

The power supply used in this project is shown in circuit diagram. We used bridge rectifier to convert the 9V supply output of transformer into DC voltage. A voltage regulator IC is used to have the fixed output voltage of +5V . For microcontroller and GSM module we have used separate supply of same specification requirement. We are use two type of analogy sensor for measurement of temperature and humidity. For measurement of temperature we use LM35 and for measurement of humidity we use SY HS-230. The actuators are used are water pump for controlling the water level of soil , heater are used to moderate the temperature , the cooler fan are used to control the humidity. The microcontroller used is ATMEGHA-16 and GSM modem is SIM-300. The TXD pin of microcontroller is connected to the RXD

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. The MODEM is the soul of such modules. A GSM/GPRS module assembles a GSM/GPRS modem with standard communication interfaces like RS-232 (Serial Port), USB etc., so that it can be easily interfaced with a computer or a microprocessor / microcontroller based system. The power supply circuit is also built in the module that can be activated by using a suitable adaptor

Mobile Station (Cell phones and SIM)

Module (SIM) together form a mobile station. It is the user equipment that communicates with the mobile network. A mobile phone and Subscriber Identity mobile phone comprises of Mobile Termination, Terminal Equipment and Terminal Adapter.



Mobile Termination is interfaced with the GSM mobile network and is controlled by a baseband processor. It handles access to SIM, speech encoding and decoding, signaling and other network related tasks. The Terminal Equipment is an application processor that deals with handling operations related to keypad, screen, phone memory and other hardware and software services embedded into the handset. The Terminal Adapter establishes communication between the Terminal Equipment and the Mobile Termination using AT commands. The communication with the network in a GSM/GPRS mobile is carried out by the baseband processor.

AT Commands AT Commands are used to control a modem. AT means Attention. Every command line starts with "AT". These are of two types : Basic and Extended.

- ATEO – Echo off
- ATE1- Echo on
- ATD –Call a dial no.
- Syntax : ATD 9479555640
- ATDL- Redial last telephone no.
- ATA- Answer an incoming call
- ATH-Disconnect existing connection
- AT+CMGS-To send SMS
- Syntax: AT+CMGS="9479555640" Press enter
Type text and press ctrl+z

AT+CMGR – To read SMS

Syntax : AT+ CMGR=1 ; reads first SMS in sim card

AT+CMGD – To delete SMS

Syntax : AT+CMGD = 1 ; deletes first SMS in sim card

VI. TEMPERATURE SENSOR LM35: -

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full -55 to $+150^\circ\text{C}$ temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to $+150^\circ\text{C}$ temperature range, while the LM35C is rated for a -40° to $+110^\circ\text{C}$ range (-10° with improved accuracy). The LM35 series is available package in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

VII. HUMIDITY SENSOR SY HS230

These module convert the relative voltage into output voltage. It work on 5V dc voltage having measuring range of 10% to 90% RH With $\pm 5\%$ RH. It have body dimension is 18 x 25 x 9mm. The output is analog voltage having range of 580 to 2870 mv. The operating temperature voltage is 0 to 60°C . This analog voltage is converted into digital by the ADC which was inbuilt in microcontroller. The output is displayed on LCD display.



Fig: Humidity Sensor

VIII. MAX232

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply

TIA/EIA-232F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels .these receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ± 30 -V inputs .Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels. The driver, receiver, and voltage-generator functions are available as cells in the Texas Instruments LinASIC library.

The real hardware implementation of circuit is as follows:

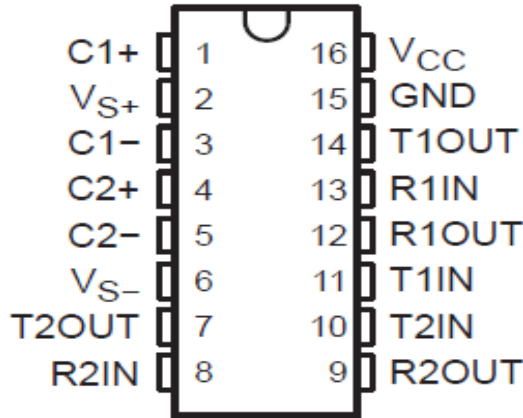


FIG: MAX 232

IX.L C D Circuit Design

Based on the recommendations in the data book of the AVR microcontroller and that of the 16x2LCD,(Ismaila and Momoh, 2011) came up with an LCD circuit shown in Fig. which was found suitable for our purpose, was used.

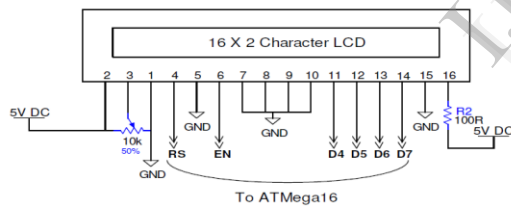


FIG: LCD Circuit



X.RESULT:

The microcontroller first cheque the conditions in program which are burn in microcontroller as per required crop condition.

Serial Number	Condition	output
01	Water present	Motor is off
02	Water absent	Motor is on
03	Temp > 40	Fan is on otherwise off
04	Hum < 50	Fan is on otherwise off
05	Temp < 25	Light is on otherwise off
06	Hum < 30	Light is on otherwise off

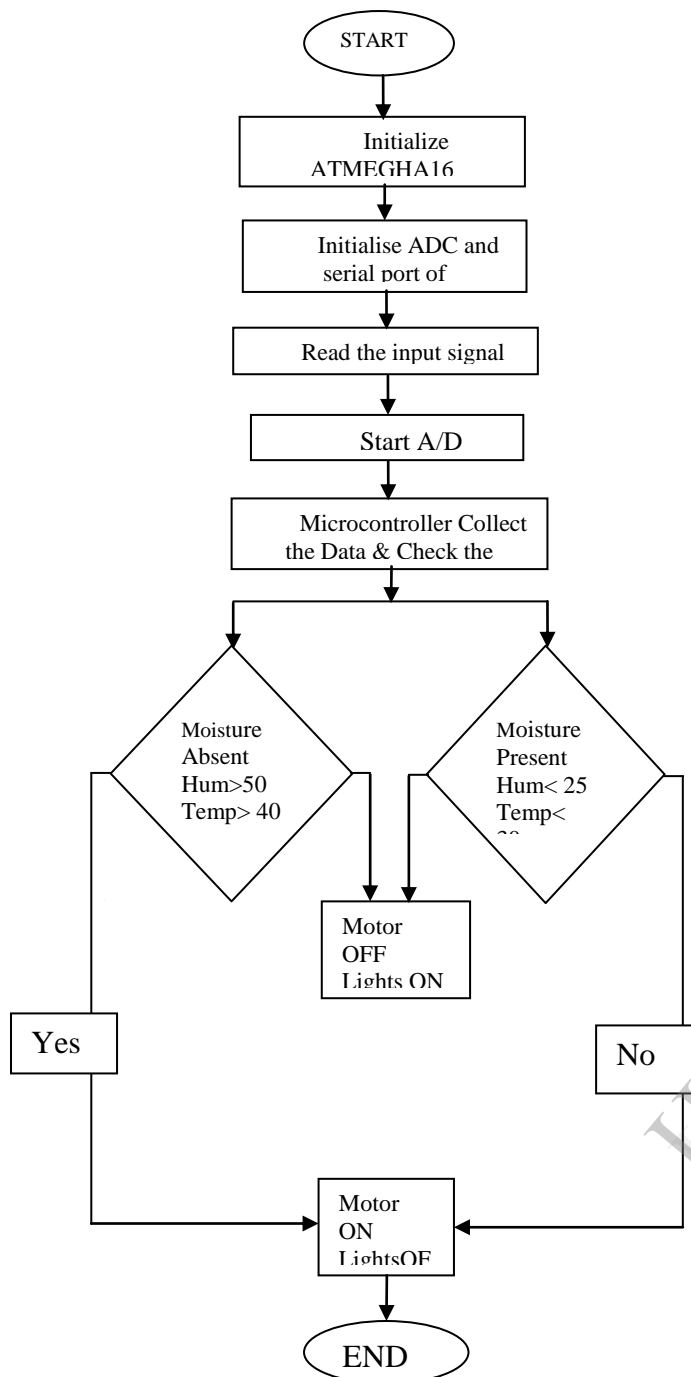


Fig: flowchart of project

Conclusion:

The system is designed for controlling and monitoring any remote equipment in greenhouse by a simple SMS from anywhere in the world via the GSM network. The developed system can be a very profitable investment because it will be able to optimize the use of the resources used in greenhouse. The GSM network operating in the design of this system has allowed us to make our greenhouse more autonomous and, thus, to adapt it to the constraints and Moroccan socio-economic realities that do not necessarily match with the technological and economic development of Western countries that are

real consumer societies. Our work has consisted mainly of optimizing simple ways (using SMS) to realize real tools for remote monitoring of climate parameters and of drip irrigation in greenhouses in Morocco by strengthening the capacity and coverage action of farmers who are often uneducated. Using this system and with a simple SMS, we can start and stop different actuators as well as know the climate under greenhouse via the GSM network from anywhere. In addition, the project is essentially a multidisciplinary educational support as well as part of a student training and research.

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