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# Low-Cost Wireless Control and Monitoring Of Greenhouse Using Labview and Microcontroller

Pranshoo Verma[1], Devesh Kumar[2]

B.Tech Pre-Final Year, KIIT School of Electronics Engineering, Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha India.[1]

B.Tech Final year, KIIT School of Electronics Engineering, Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha India.[2]

**ABSTRACT:** A greenhouse is a structure with walls and roof made mainly of a transparent material such as glass. The climatic conditions are made proper to maximize the cultivation, by maintaining water level, moisture in soil and light conditions. An Automated Greenhouse is a machine based system automating/regulating the conditions for cultivation by using hardware-software combinations. The project focuses on the automation of the greenhouse system which allows the user to control sprinkler/motors, light according to the need from any location in the world. Moisture content present in the soil is measured by a Soil Moisture Sensor. The temperature sensor is used to get the ambient temperature. As temperature and moisture has an important role in the growth of a plant, the water availability in the tank is sensed through Water Level Detector. The detector/sensor's output is fed to the microcontroller, Then the sensors value goes to the web server (Online Database) by GSM/GPRS module. The temperature value, water tank level, light intensity, sprinkler/motor status, artificial lights status, all can be monitored/control by the help of LabView. LabView data exchange is done with the web server (Online Database).

**KEYWORDS:** Arduino Uno Microcontroller, LabView, GSM/GPRS module, Water level sensor, Soil moisture sensor, Web server, Temperature sensor.

## I. INTRODUCTION

Planting trees is both an art and science. Almost 9/10$^{th}$ of plants are grown in an open field. The man knows how to cultivate under natural environmental conditions. In some of the regions where conditions/external factors for cultivation are not fulfilled then no crops can be grown, but the man has been able to invent many methods to grow crops in such adverse conditions, which is called Greenhouse. The greenhouse has many advantages such as 1. Good distribution of light inside the greenhouse, 2. Control and establish the optimal

environment for cultivation, 3. Protection against diseases, pests and other vermicides. 4. Ability to grow all the year and many more advantages. The proposed methodology was implemented to monitor soil moisture, water tank level, Light intensity, ambient temperature and to control motors, artificial lights. The coding in the Arduino is done using Arduino IDE. LabView allows the user to ON/OFF motors and lights in the field from any location. The values of sensors in Arduino is sent to the web server (Online database) by GSM/GPRS module through HTTP Client protocol in every few seconds, and LabView fetches the sensor values from a web server using HTTP Client protocol. The user can see the real-time statistics of the field in LabView, the ON/OFF signals for motors and lights are given by user from LabView which are sent to Arduino back.

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## II. RELATED WORK

**1**.In 2010 Mahesh M. Galgalikar proposed 'Real-Time Automization of Agricultural Environment for Indian Agricultural System'[3]. This system uses ARM7/TDMI Core 32-bit microprocessor, GSM services. The link between ARM processor and the centralized unit is GSM services which operate through SMS which is used to inform the user about the field conditions (such as soil moisture, dew point, temperature, humidity) on request, the model operates on AT commands. Thelimitations of this system are that 1. It has a maximum cell site range of 35km(fixed), 2. The entire AT commands need to be familiarized by the farmer (user).
**2**.In 2014 S. Siva Sankari, Dr.G. Mary Jansi Rani proposed 'A wireless Monitoring and Controlling Automatic Irrigation Field' [5]. The system uses 2 PIC microcontrollers and 2 GSM/GPRS modules along with some sensors. The value of Soil Moisture Sensor and Water level detector is fed to the microcontroller and then it is transmitted through GSM/GPRS module to another GSM/GPRS module where the values are fed to LabView through LAN connection. The main Limitations are 1. User side system that is monitoring and control is not portable as it uses LAN connection to convert received data to LabView. 2. The whole setup is costly as it uses 2 GSM/GPRS and 2 PIC microcontroller which can be replaced by 1 each.

**3**.In 2010 Vasif Ahmed, Siddhart A. Ladhake proposed 'Ultra Low-Cost Cell Phone-Based Embedded System for Irrigation' [3]. The system makes use of ATMega32 microcontroller, RTC DS1307 and DS18S20 used for time and temperature measurement. It has features like protection against single phasing, over current/voltage, dry running. The ideal water distribution in fields is provided by the system based on SMS from cell phones, a number of missed calls in specified time duration, manual settings. The only limitation is that it needs extra storage memory in case other sensors need to be added and uses same network operator for control system and user cell phones.

**4**.In 2008 Yunseop Kim proposed 'Remote sensing and control of an irrigation system using distributed wireless sensor network' [1]. In-field sensing stations have been used in this system for sensing different parameters such as Micro metrological information of field, land and weather stations. It incorporates Bluetooth and TCP/IP technology for transmitting data wirelessly. Hence giving low-cost solution for wireless sensor network. The drawback of the system is its main limitation of the range of operations of Bluetooth technology which is limited to a few meters. In addition to this it's a prerequisite for the controlling such device(s) to have a dedicated Bluetooth module and if it is shared among various devices it results in access delay which causes major interference.

## III. SCOPE OF RESEARCH

In this paper, Greenhouse field is monitored and controlled automatically using Wireless technology with low cost, less complex, effective solution. The above research gives insight about various controllers and technologies. The techniques were implemented with various controllers like AVR Atmega16,8051 PIC microcontroller etc were used for data acquisition system from different sensors. Hence in this proposed methodology, Arduino Uno microcontroller is used for the monitoring and controlling purpose.

## IV. PROPOSED METHODOLOGY

The Figure represents a block diagram of an automatic greenhouse field system.

### BLOCKDIAGRAM DESCRIPTION

Water Tank level sensor is used to check the level of the water in the Tank, similarly, a Temperature sensor used to get the ambient temperature, LDR (light dependent resistor) that is used to get the intensity of light, soil moisture sensor to get the moisture content. These all values from the sensors are fed to Arduino in every few seconds. The Arduino sends the value to the web server that is having online database through GSM/GPRS module using HTTP Client Protocol by GET and POST methods.

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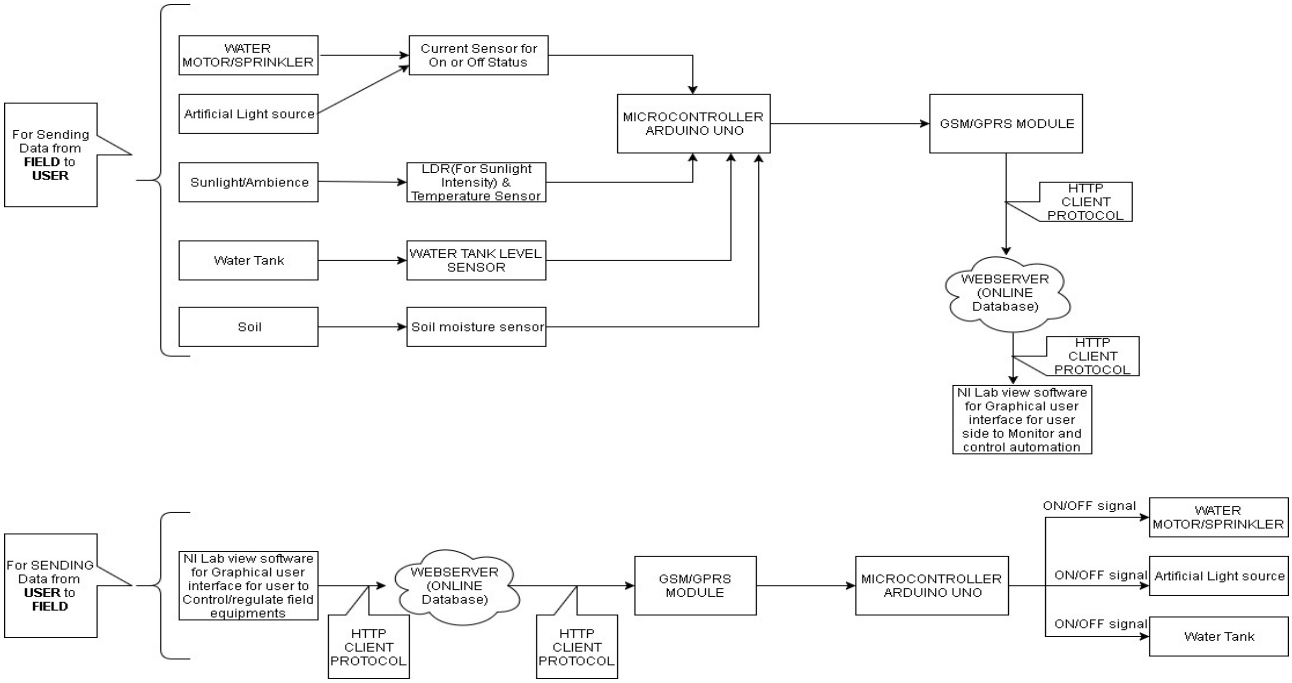


NI software LabView which is used as Graphical user interface where all the values of the sensors are shown with digital meters in it. LabView fetches the data from webserver in every few seconds and updates the values of each meter, motor ON/OFF status, Lights ON/OFF status and the graph (it shows the last 50 minutes reading of moisture in graphical form). For user control, there are few buttons like START/STOP MOTOR and START/STOP LIGHT, so if the user presses any button the LabView gets the response and sends the value to the webserver through HTTP Client protocol. The field side Arduino fetches the value from the database, and sends the ON/OFF signals to the MOTOR and LIGHTS.

## V. LABVIEW SIMULATION/WORKING

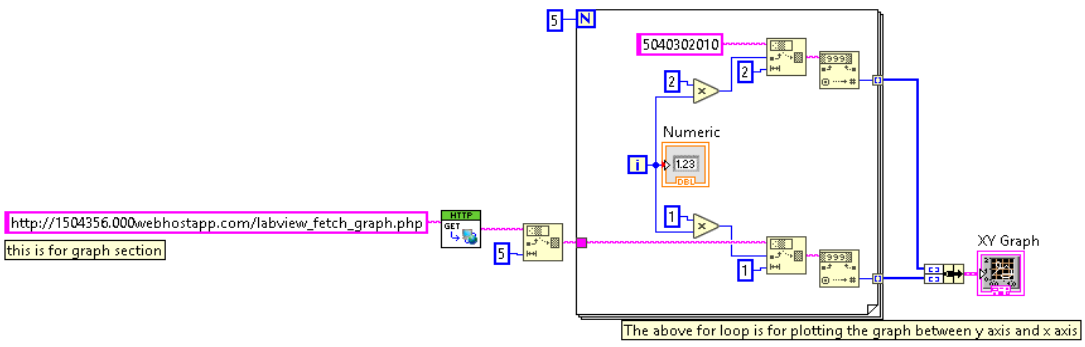


Fig.1.0Block Diagram for getting graphical output

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This part fetches last 50 minutes reading of soil moisture from the database and shows the characteristics curve. The protocol used here is HTTP Client protocol and from GET method, the values are fetched.This is the curve shows the last 50 Minutes reading against moisture.

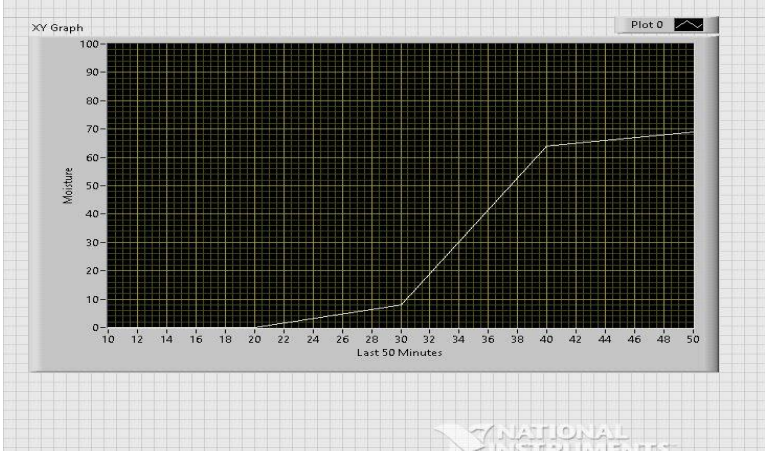


Fig.1.1Graphical Output of the System

This part of graphical diagram fetches the in-field sensors value from the database in every few seconds and update the GUI correspondingly, which shows Light Intensity, Ambient Temperature, Water Tank Level, Moisture level, Motor and Lights ON/OFF status. HTTP Client protocol is used for getting the data by GET method.

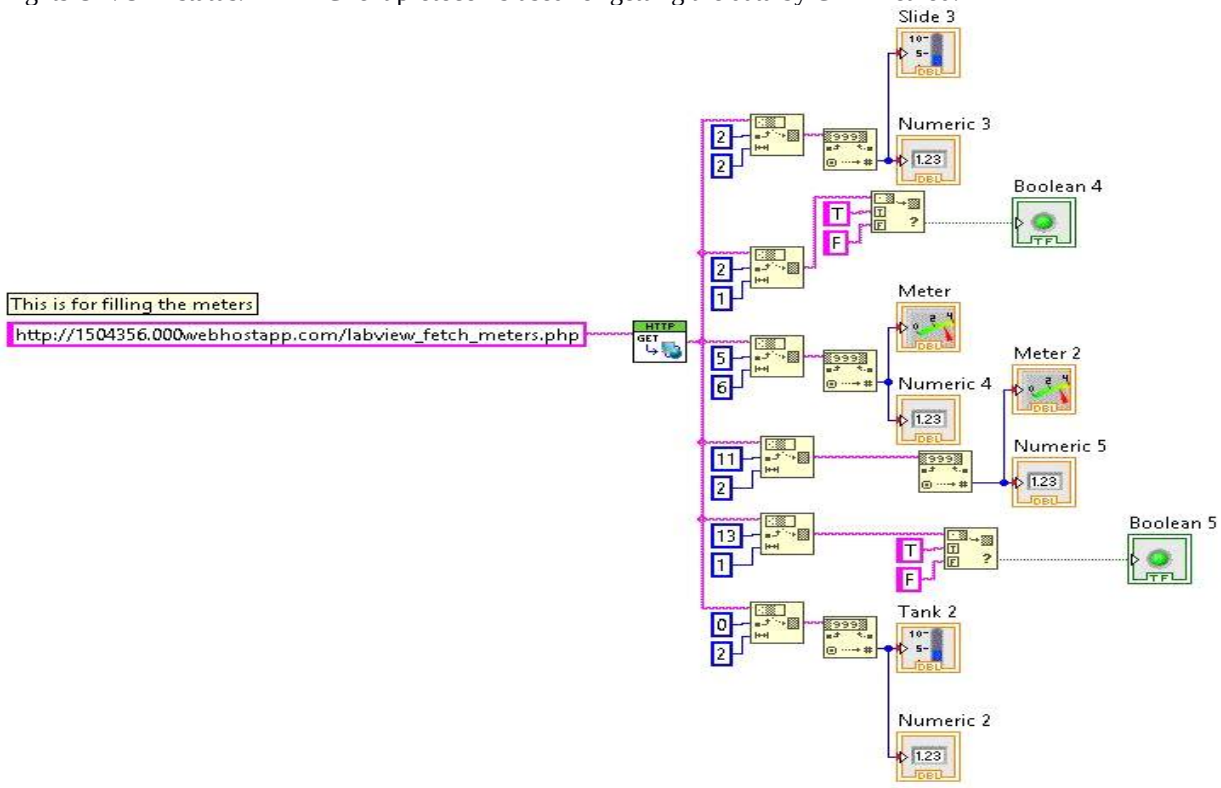


Fig.1.3 Block Diagram of System.

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This shows the current state of the field to the user and gets automatically updated in every few seconds

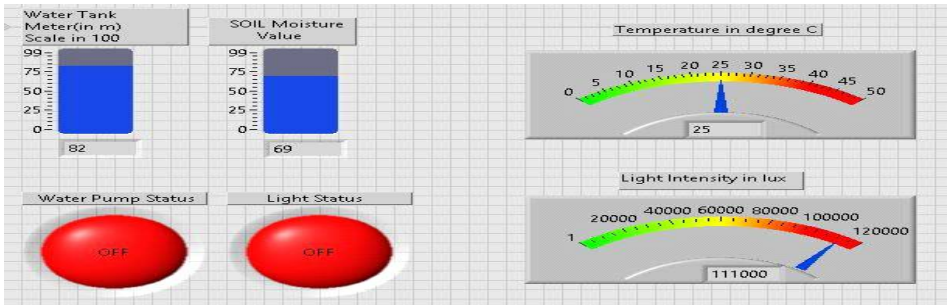


Fig.1.4 GUI (Graphical User Interface) of Thermometer and Light intensity along with the live details of soil moisture and water in tank

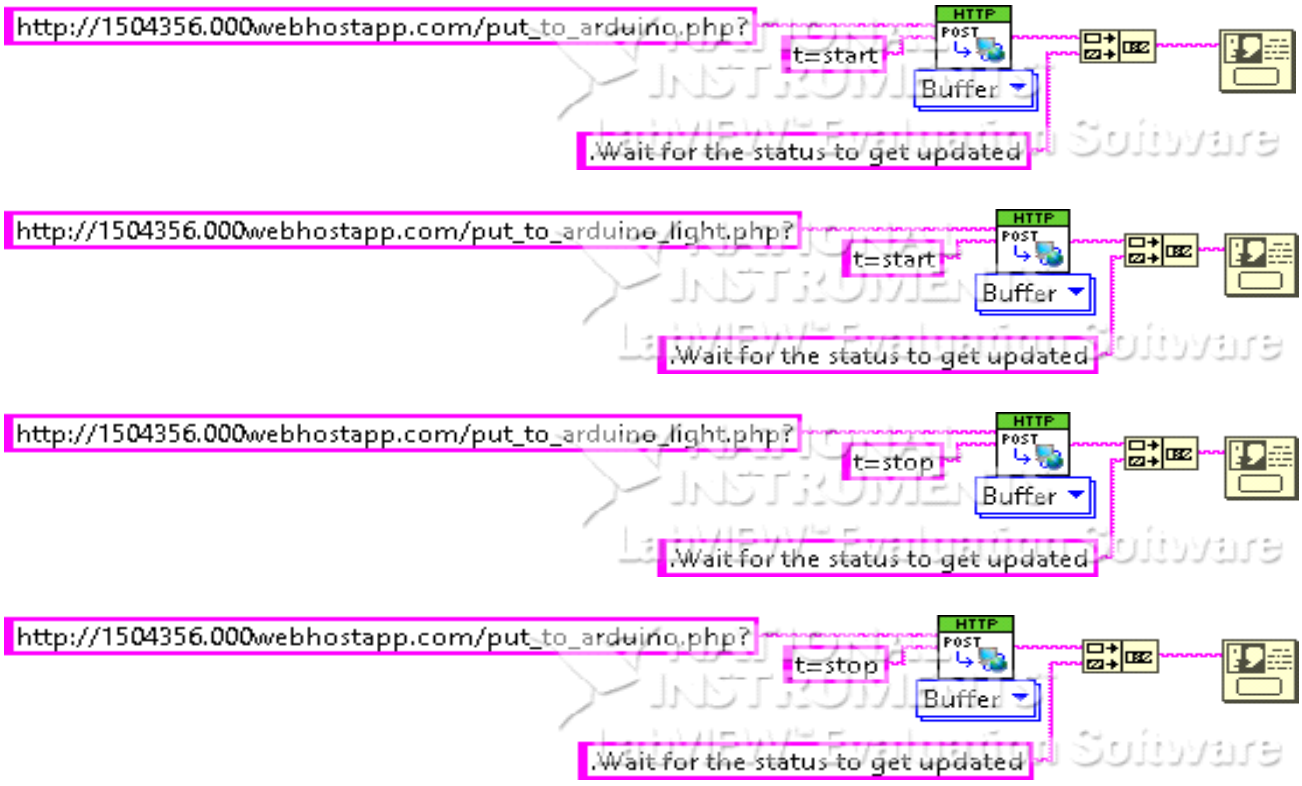


FIG.1.5Status report

This is the controlling part for the user, GUI has 4 Buttons to START/STOP Motor and LIGHTS. The values are sent to the web server from LabView through POST method of the HTTP protocol. As in field side, the Arduino is continuously fetching values that are sent by the user from the web server to START/STOP Motor and Lights. The panel is shown below in which the user sets the instruction to START/STOP motor and lights as per the requirement, which gets reflected in the field within few seconds.

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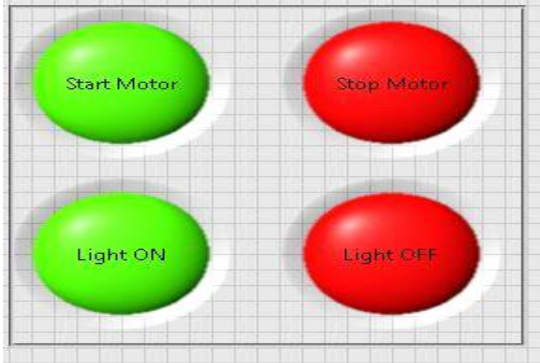


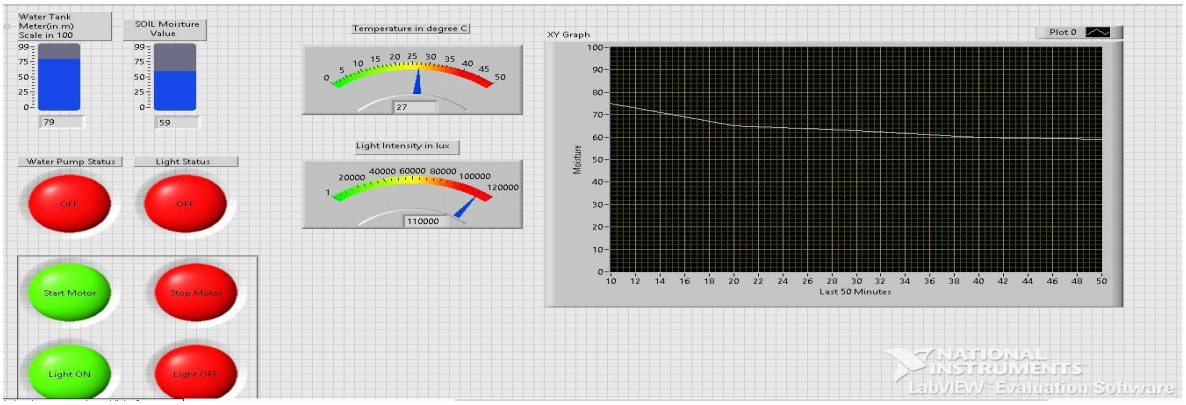

Fig.1.6 GUI (Graphical User Interface) of System

**VI. RESULT**

The table shown below has last 50-minutes parameters from the field.

| Water Tank Level | Moisture | Motor status | Time | Light Intensity | Temperature | Light status |
|---|---|---|---|---|---|---|
| 79 | 75 | FALSE | 14:10 | 111000 | 27 | FALSE |
| 79 | 65 | FALSE | 14:20 | 111000 | 27 | FALSE |
| 79 | 63 | FALSE | 14:30 | 111000 | 27 | FALSE |
| 79 | 60 | FALSE | 14:40 | 111000 | 27 | FALSE |
| 79 | 69 | FALSE | 14:50 | 111000 | 28 | FALSE |

The corresponding GUI in LabView is shown below, which is showing all the readings of the latest parameters (that is at 14:50) and the graph shown in GUI is the curve between moisture and time and it plots last 5 readings from the database.



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## VII. CONCLUSION

Thus, the proposed methodology has been implemented in LabView and in Web server for monitoring and control of various field parameters. Thus, the user can view the sensor data and control the motor and light status through remote monitoring of agricultural field via Web technology.

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