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Real Time Automization of Agriculture System Using Arm7

Debidatta Acharya*, Surya Narayan Pradhan**, Soumyashree Mongaraj***
* M.Tech Student (Department of Electronics & Telecommunication, Kalinga Institute of Industrial Technology, Bhubaneswar, India)
** M.Tech Student (Department of Electronics & Telecommunication, Kalinga Institute of Industrial Technology, Bhubaneswar, India)
*** Assistant Professor (Department of Electronics & Communication Kalinga Institute of Industrial Technology, Bhubaneswar, India)

ABSTRACT
This project is used to detect the field conditions and to provide information about the field. This involves some sensors, LCD display, GSM and ARM7 processor. We have to connect all the sensors to the ADC channel pins which are in-built to the ARM processor.LCD will be on field display purpose. GSM module will contains a Subscriber Identity Module (SIM) user can communicate with this SIM-Number. When the particular command activated or given by the user, immediately the corresponding sensor will activates and reads the present reading and immediately sends results to the same user mobile and displays in the LCD panel in the field. Immediately the necessary action will take place if required. Here we are using total Five sensors to monitor the field condition. Those are Temperature, Humidity, Soil moisture, PIR sensor, Level sensor.GSM is used for communication purpose, with the help of AT (attention)-Commands we can communicate with the components.
Keywords— ARM7 LPC2148 Microcontroller, GSM Modem, User Mobile Phone, Sensors

I. INTRODUCTION

Modern agriculture offers a range of benefits, including greater production and higher incomes for farmers including small producers in both developed and developing countries. Technical advances also have sharply reduced environmental impacts, enabling reduced pesticide, herbicide and fertilizer use, less tillage, and less land and water use per unit of output all decreasing pressure on fragile global ecosystems. It is clear that we have a productivity gap going forward, a gap that we must begin now to close. If we are to double agricultural output by 2040 and do so with basically the same amount of land and water as we have today while also reducing the environmental footprint then clearly we must become more productive than we have been in the past. That is the productivity gap, which is our challenge. This is my simple concept and approach, to bring our agricultural system into the world class recognition. This system is completely independent from desktop computer and do not require computers to run. The system runs on the program stored in ROM of microcontroller. The program is written in embedded C language and microcontroller is turned on that program on which entire hardware runs.

An automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor Information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity [1].

Yang et al. reported a multi-functional remote sensing system that integrates RFID technology with spectral imaging and environmental sensing in a greenhouse. The multi-spectral imaging system was used for remote sensing of the canopy of cabbage seedlings. Greenhouse temperature, relative humidity, and lighting conditions were measured above the crop [4].

Yoo et al. described the results of real deployment of a WSN IEEE 802.15.4 compliant system to monitor and control the environment in greenhouses where melons and cabbages were being grown [6].

Baggio deployed a WSN for fighting phytophtora in a potato field. Phytophtora is a fungal disease which depends on the climatological conditions. 868/916 MHz motes were used for measuring humidity and temperature. The aim of the system was to reveal when the crop was at risk and let the farmer treat the plants only when really needed [7].

Beckwith et al. implemented a WSN in a vineyard consisting of 65,916 MHz motes. Temperature measurements were collected during one month. The information was used for addressing

two important parameters in wine production: heat accumulation and potential frost damage [9].

1.1 Proposed System: In this system, sensors are used to analyze moisture & water content of agriculture field. This is completely based on scientific methods and using this we can observe agriculture field continuously. The real-time automization system, we are developing is an alternative and efficient method for Agriculture. This system reduces water usage in any agriculture land. It also increases yields and quality by controlling watering to land. The system reduces human effort and it is also easy to use project.

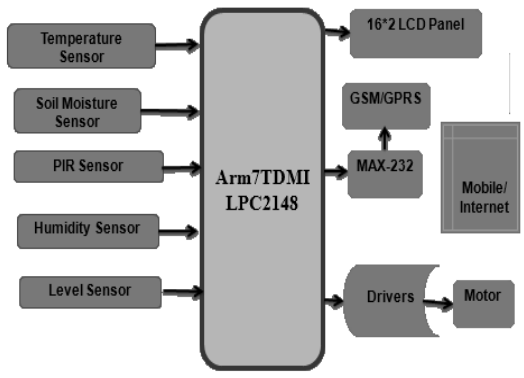
II. DESIGN OF SYSTEM STRUCTURE:

Parts: Sensors, GSM Module, Microcontroller.

Sensors are used to check whether the soil is wet or dry, leaf condition, soil condition & water level and it returns the value to microcontroller which is digital value (1 or 0). This digital value is send to microcontroller for further processing. GSM Module used here works as a bridge between user and device. When a particular command activated or given by the user, immediately the corresponding sensor will activate & read the present reading & sends results to the same user mobile & display in the LCD panel in the field. Microcontroller is the main part of this system. Microcontroller takes decision based on sensor reading & send notification to user mobile by GSM Module. All these functions are necessary to run this system.

III. IMPLEMENTATION OF SYSTEM HARDWARE & SOFTWARE

Sensors are periodically collect information of temperature, humidity, soil moisture, water level etc. and send it together to the microcontroller. Sensors connect to irrigation controller through the serial port and upload data.



"Fig.1 Block diagram"

The above parameters as discussed in the block diagram will monitor the field and gives the accurate result. Temperature, Humidity, Soil, Level, PIR sensors. In case of soil moisture, we will check weather soil is dry or wet. If it is dry means, this condition is very harmful to plants. So immediately release the water into the soil and make it wet. For this we will use the level sensor which is very useful. Temperature and humidity are useful in the case of monitoring the weather conditions. And we are using the two ac motors, one is for the bringing the water into the storage from ground. Whereas another one is helpful in case of sending water into field from the storage.PIR Sensor is used to monitor when any animal or unknown person enter into the field to destroy or stealing the crops in the field.

Hardware Design:

LPC2148 Microcontroller:

The LPC2148 microcontrollers are based on a 32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combine microcontroller with embedded high speed flash memory upto 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. This board is powered by USB port and does not need external power supply. It is ideal for developing embedded applications involving high speed wireless communication (Zigbee / Bluetooth / WiFi), USB based data logging, real time data monitoring and control, interactive control panels etc. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

"Fig.2 LPC2148 Microcontroller"

GSM MODEM:

GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL -Modem is SIM900 Quad-band GSM / GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use

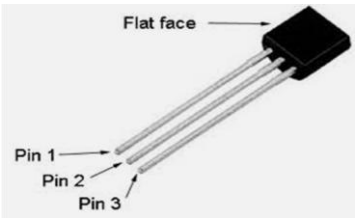
as plug in GSM Modem. The Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600- 115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication).

"Fig.3 GSM Modem"

Some Useful AT Commands for Communication:
To initialize GSM module type 'AT' in capital letters and then press enter key on keyboard. If there are no errors occur in this communication then it will send 'OK'.
To send SMS type following commands
AT+CMGF=1, press enter key,
It will return 'OK' then proceed,
AT+CMGS="9937930063" <user can put any 10 digit number>
type message after getting letter '>'
after end of SMS press Ctrl+z on keyboard
If it returns '+CMGS: 203' (or any other number)'OK' then SMS sent successfully.
To dial a call type following commands
ATD+919876543210; <user can provide any 10 digit number with country code>
it will return 'OK' if there are no errors occurs in communication
to disconnect type ATH
if it returns 'OK' it means call disconnected successfully.

Temperature Sensor (LM35):

The LM35 is applied easily in the same way as other integrated-circuit temperature sensors, with an output voltage linearly proportional to the Centigrade temperature. Thus the LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.



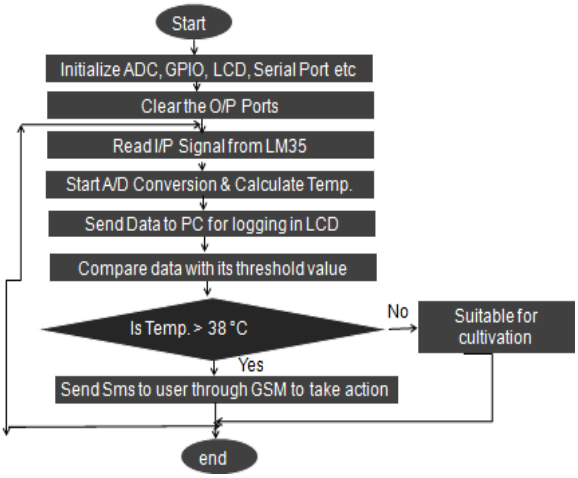
"Fig.4 LM35 Sensor"

Humidity Sensor (HSM20g):

The module of HSM-20G is essential for those applications where the relative humidity can be converted to standard voltage output.

"Fig.5 HSM20g Sensor"

Software Design for Temperature Sensor Monitoring:



"Fig.6 Flow chart for LM35"

Experimental Results for Temperature Sensor Monitoring for Rice Harvesting:

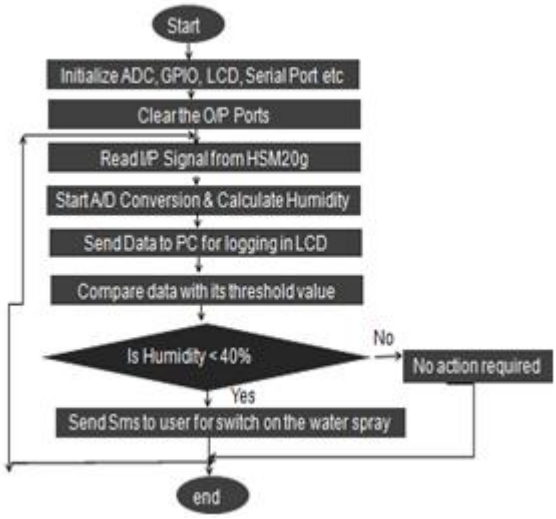
"Fig.7 Outputs for LM35 sensor on LCD & Mobile Phone"

Soil Moisture Sensor:

Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use is a Frequency domain sensor such as a capacitance sensor. Another sensor, the neutron moisture gauge, utilize the moderator properties of water for neutrons.

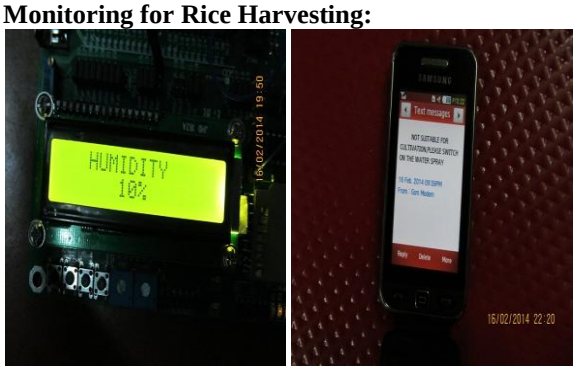
"Fig.8 Soil Moisture Sensor"

Software Design for Humidity Sensor Monitoring:



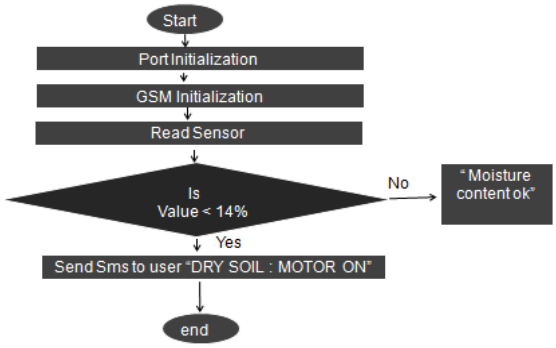
"Fig.9 Flow chart for HSM20g"

Experimental Results for Humidity Sensor Monitoring for Rice Harvesting:



"Fig.10 Outputs for HSM20g sensor on LCD & Mobile Phone"

Software Design for Soil Moisture Sensor Monitoring:



"Fig.11 Flow chart for Soil Moisture"

Step1: Start
Step2: Initialize all ports
Step3: Initialize LCD, GSM & Serial communication
Step4: if(Moisture < Threshold value i.e 14%)
True,
Go to step 8
Step5: if(Moisture > Threshold value i.e 14%)
True,
Go to step 7
Step6: Introduce delay
Go to step 4
Step7: " MOISTURE CONTENT OK, SUITABLE FOR CULTIVATION"
No action required
Go to step 4
Step8: " DRY SOIL : MOTOR SHOULD BE ON"
Send message through GSM, introduce delay
Go to step 4

" Fig.12 Algorithm for Soil Moisture Sensor Monitoring"

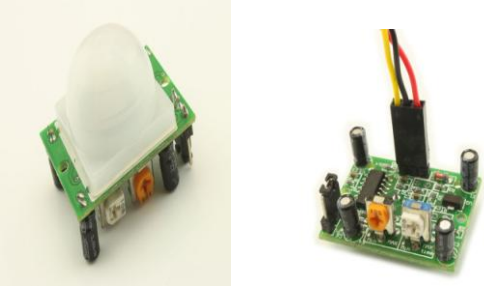
Experimental Results for Soil Moisture Sensor Monitoring for Rice Harvesting:

"Fig.13 Outputs for Soil Moisture sensor on LCD & Mobile"

PIR Sensor (DYP-ME003):

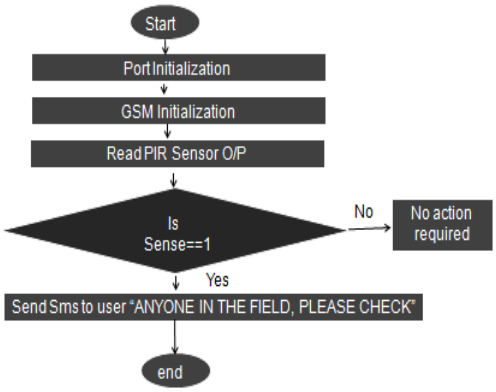
DYP-ME003 is a Passive infrared Motion sensor module, and its sensitivity is adjustable and based on BISS0001 PIR motion detector IC which was widely used in:

- security Products, human body sensor toys
- the human body sensor lighting
- industrial automation and control, etc.



"Fig.14 PIR Sensor"

Software Design for PIR Sensor Monitoring:



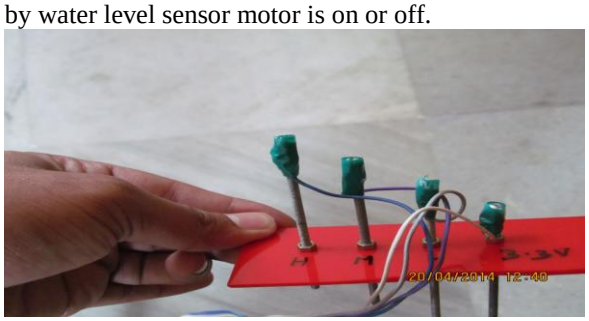
"Fig.15 Flow chart for PIR Sensor"

Experimental Results for PIR Sensor Monitoring:

"Fig.16 Outputs for PIR sensor on Mobile Phone"

Water Level Sensor:

For level sensing in the water tank in the field for watering purpose water level sensor is used. According to the indication of the water level sensed by water level sensor motor is on or off.



"Fig.17 Water Level Sensor"

When the water level becomes Very Low, the motor will turn ON; the LCD backlight will automatically turned ON for 5 seconds. After this, when the water level reaches Full level, the motor will automatically turned OFF, and the LCD backlight will automatically turned ON for 5 seconds. During normal operation you can manually turn on LCD backlight by pressing the Push button switch. The LCD indicates the Level of water (‘Very Low’, ‘Low’, ‘Medium’, ‘High', 'Full’) and the status of the motor (‘ON’ or ‘OFF’).

Functional Requirements:

These are the main functions in this project which are mandatory to run this project:

- Sensor readings are read by microcontroller.
- Signal from sensor are analyzed by microcontroller.
- Notification is sent to GSM Module to send it to user mobile.

User Characteristics:

All users can be assumed to have the following characteristics:

- Ability to read and understand English language in order to understand the data sent from microcontroller in SMS format.
- Familiarity with basic operations of a cell phone as cell phone is used as user interface.
- Knowledge of using Short Message Service (SMS) provided by the service provider.

Advantages:

- Real-time response, monitoring and controlling.
- Checking the weather conditions and intimating to user.
- It will protect each and every issue regarding plant growth.
- Controlling and managing whole system

through GSM.

Applications:

- Industrial automation system
- Weather Station
- Home automation system

IV. CONCLUSION

The project is thus carried out using ARM7TDMI core with the help of GSM technologies. This project finds application in domestic agricultural field. In civilian domain, this can be used to ensure faithful irrigation of farm field, since we have the option of finding out moisture level of soil in a particular area.

V. FUTURE SCOPE

- It can also be designed to detect the Soil condition acidic or base using PH Sensor
- ARM-controller with a video capturing and sending it to user as MMS about the total crop position or to know the total crop condition.
- We can connect to the nearer weather station to know the up-coming weather changes through satellite communication irrespective of time.
- We can also used it as a web based to use through internet.

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