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ARM Based Corn Crop Monitoring System Implementation


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Abstract

Indian Agriculture is dependent on the monsoons which is not a reliable source of water. Therefore there is a need for an irrigation system in the country which can provide water to the farms according to their soil types. This paper deals with design and development of implementation of corn crop monitoring system using ARM cortex M3 controller.

Agriculture is a very unpredictable occupation. The yield depends on a complex combination of a lot of factors like irrigation, climate, fertility of soil, and freedom from pests. Thus, the farmer has to take care of a lot of factors simultaneously. The proposed system aims to help the farmer focus on other aspects of agriculture, by automating the entire process of irrigation. Agricultural corn of the plants crop monitoring purpose with the help of combination of self-learning and decision makes power of WSN, and using the ZigBee technology is based on short range WSN and is useful to reduce hard work of farmer's. In this work, we can use the sensor nodes with sensors attached with it such as humidity sensor, temperature sensor, Water level sensor, LDR sensor.

Climate has the potential to affect agriculture through changes in temperature, and the interaction of these elements attached to it. Irrigation of a field is releasing the amount of water required by the crops depending on the amount of water that can be absorbed by the soil. Using the sensed parameters, this system calculates the optimum amount of water to be released. The system then releases the calculated amount of water into the field. By releasing neither too much of water nor too less of it, the system ensures the efficient and effective use of water and also prevents the wilting of crops.

Index terms: ***Humidity, temperature, soil moisture, LDR sensors, ARM CORTEX M3 LPC1768 microcontroller, RTC and zigbee modules.***

INTRODUCTION

Highly interaction in human machine in daily lives has made user interaction progressively very important. Expansion of sensor based advanced technology sophisticated human force and stress along with power conservation with automation system. This paper aims in design and helps the farmer to focus on other aspects of agriculture, by automating the entire process of irrigation. It also depends on the climatic factors, the most important of them being – air temperature and soil moisture. The system uses sensors to sense air temperature and soil moisture from the field. The controlling device of the whole system is a Microcontroller. The Microcontroller is programmed using Embedded C language. The growth of crops involves a lot of factors and these factors have to be monitored very carefully for their healthy growth. But, precisely, there are three important things which are needed for the growth of a crop

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Growth of Crops

- Soil: A crop is cannot be grown in any soil and a soil is not suitable to all crops. A particular crop can grow only on certain types of soil.
- Water: Only freshwater can be used to irrigate the crops. Salt water cannot be used to water the crops. Agriculture requires withdrawal from freshwater resources. Agriculture is a major draw on water from aquifers.
- Sunlight and climate: Climate has the potential to affect agriculture through changes in temperature, rainfall (timing and quantity), sunlight and the interaction of these elements.

Fig-1: Image of the proposed model water level monitoring display on LCD

Based on this, farmer can follow two types of irrigation systems:

Time-based system

In this, time is the basis of irrigation. Time of operation is calculated according to volume of water required and the average flow rate of water. Water is released for that time. It is approximate in nature.

Volume-based system

In this, volume of water is the basis of irrigation. Amount of water to be supplied is computed and then released. It is comparatively accurate than time-based system. The purpose of system is to implement the remote wireless communication between MCU and PC monitoring section using Zigbee wireless modules. The proposed project aims in designing an automatic operated system which is capable of controlling the electrical devices based on the sensors unit. This system creates a new era in the automation system. This system integrates human-machine interface.

Fig-2: Image of the corn crop implementation

RELATED WORK:

Today many farmers in different parts of the country are taking up contract farming of baby corn on behalf of food processing companies. The companies supply the farmers with high quality inputs - including hybrid seeds - besides cultivation knowhow. The harvested crop is then bought from the farmers at a predetermined price. This crop is processed and then mainly exported to the overseas market. With a market for their produce assured and an estimated net income of Rs 16,000 per acre farmers are finding baby corn an attractive crop to cultivate. Baby corn cultivation is a recent development. It was Thailand in the early 1970s that first seriously started cultivating this crop for exports.

Later other countries like Guatemala, Zambia, Zimbabwe and South Africa started cultivation. Today Thailand and China are the world leaders in baby corn production. The growth of baby corn exports from Thailand has been amazing. From 67 tonnes worth U.S.$38,059 in 1974 their exports had risen to 3676 tonnes worth of U.S.$ 33 million in 1992. In India its cultivation is only now picking up in a serious way in Meghalaya, Western UP, Haryana, Maharashtra, Karnataka and Andhra Pradesh. Now leading private sector companies in India like Advanta Limited are offering hybrid baby corn seeds. The cultivation technique has also now been more or less standardized.

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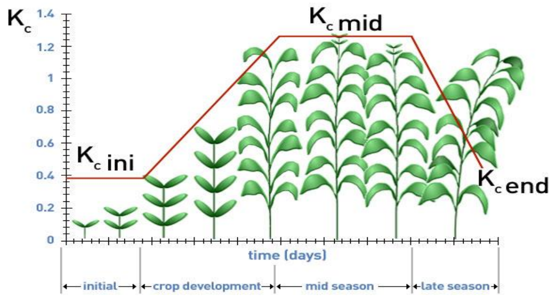


Fig-4: Image of the graph of the cultivation of corn crop

Proposed Work:

HARDWARE DESIGN OF PROPOSED SYSTEM

In this paper we presented an advanced wireless sensor network for corn crop implementation and automation according to the sensors detection with timings using RTC and monitoring using wireless zigbee communication along with PC and ARM LPC 1768 microcontroller.

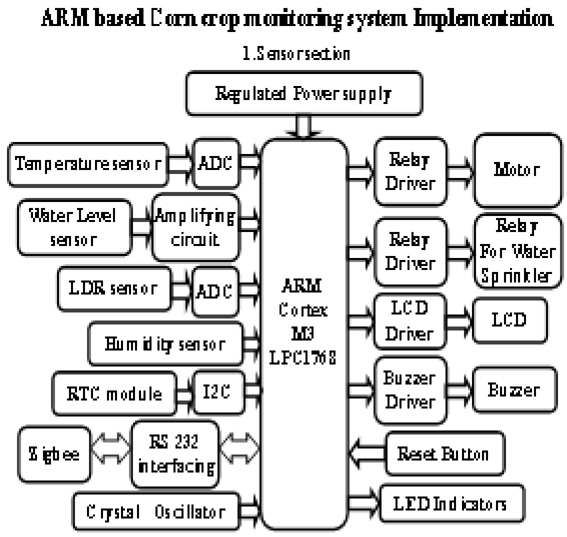
The purpose of system is to implement the remote wireless communication between MCU and PC monitoring section using Zigbee wireless modules. The proposed project aims in designing an automatic operated system which is capable of controlling the electrical devices like water pump, or water sprinkler based on the sensors unit. This system creates a new era in the automation system. This system integrates human-machine interface.

The proposed working model of the system consists of two sections mentioned below

Transmitter or Sensors section near fields-

The objectives of the project include:

- Sensing different parameters (temperature, water level, Humidity, LDR sensors).
- Monitoring status of parameters is displayed on PC using wireless zigbee.
- Producing buzzer alerts for sensor based detections.
- Real time clock based stages detection of plants growth
- Automatic controlling of electrical devices (water sprinkler, irrigation motor).



In the proposed model we use an advanced ARM microcontroller LPC1768 of Cortex M3. The LPC1768/67/66/65/64 is ARM Cortex-M3 based microcontrollers for embedded applications featuring a high level of integration and low power consumption. The ARM Cortex-M3 is a next generation core that offers system enhancements such as enhanced debug features and a higher level of support block integration.

The LPC1768/67/66/65/64 operates at CPU frequencies of up to 100 MHz. The ARM Cortex-M3 CPU incorporates a 3-stage pipeline and uses Harvard architecture with separate local instruction and data buses as well as a third bus for peripherals. The ARM Cortex-M3 CPU also includes an internal prefetch unit that supports speculative branching.

The peripheral complement of the LPC1768/67/66/65/64 includes up to 512 kB of flash memory, up to 64 kB of data memory, Ethernet MAC, USB Device/Host/OTG interface, 8-channel general purpose DMA controller, 4 UARTs, 2 CAN channels, 2 SSP controllers, SPI interface, 3 I2C-bus interfaces, 2-input plus 2-output I2S-bus interface, 8-channel 12-bit ADC, 10-bit DAC, motor control PWM, Quadrature Encoder interface, four general purpose timers, 6-output general purpose PWM, ultra-low power Real-Time Clock (RTC) with separate battery supply, and up to 70 general purpose I/O pins

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Receiver or Monitoring section-

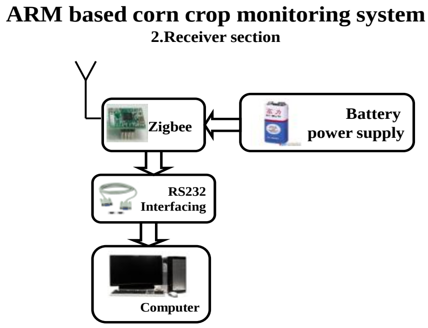


Fig-10: Block diagram of receiver section of the proposed model

In the remote monitoring section of the proposed system we interface the zigbee module directly to PC for monitoring the sensors data of corn crop analysis using RS232 cable and MAX 232 is a chip which converts the voltage level from TTL levels to RS 232 levels or vice versa. When communicating with various micro processors one needs to convert the RS232 levels down to lower levels, typically 3.3 or 5.0 Volts.

Monitoring or PC section-

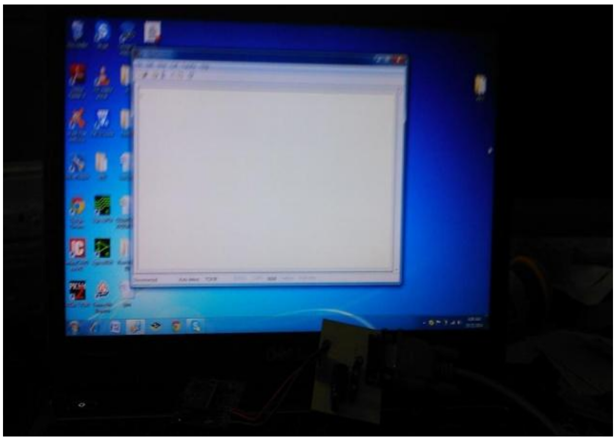


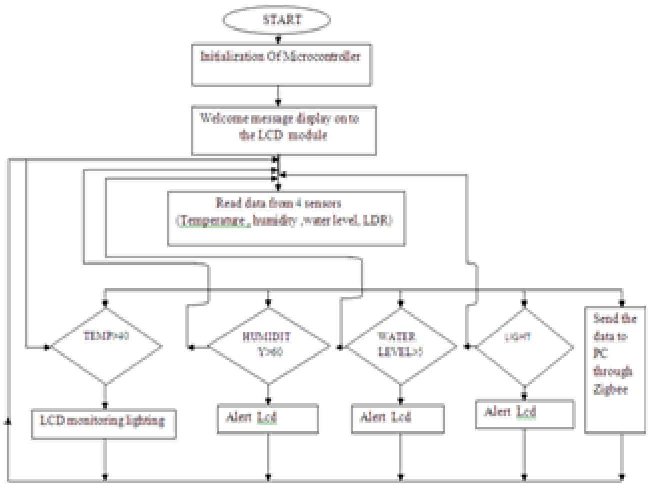
Fig-11: HyperTerminal window on monitor

The remote controlling section consists of PC, zigbee transceiver module and a battery for the module to enable. User needs to follow the steps to connect hyper terminal of the PC.

START—All Programs—Accessories—Communications—Hyper Terminal—now the user should can enter a suitable name for his/her hyper terminal (Ex-abc)—now needs to select com port (generally COM1) —one dialogue box gets opened—need to enable the restore setting button to select the properties of select communication—hyper terminal window gets connected.

Connect a zigbee module at the com port of PC using DB-9 Serial RS-232cable.

FLOW CHART:



This involves some sensors, LCD display, Zigbee wireless modules and ARM LPC1768 (COTEX M3) processor. The controlling device of the whole system is done using ARM cortex M3 LPC1768 Microcontroller. Whenever the sensors unit gets the input from respected sensors like temperature LM35 sensor, water level indicator sensor LM324, LDR sensor, humidity sensor, and these inputs are fed to the ARM cortex M3 LPC1768 Microcontroller. The ARM cortex M3 LPC1768 Microcontroller performs appropriate task related to the data received like motor ON/OFF control. The ARM cortex M3LPC1768 Microcontroller used in the project is programmed using Embedded C language. The system also uses RTC module to detect the time period of the stages of growth of the plants.

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An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

CONCLUSION

An existing remote corn crop implementation and parameters monitoring using wireless zigbee was designed such that the sensors data base from temperature, LDR, humidity water level detection in soil, along with timing and the system wirelessly monitors using Zigbee technology. It can also used as an automatic operated system which is capable of controlling the electrical devices like water pump, sprinkler based on the sensors unit. Using four sensors related to crop care monitoring while cultivation period such This system creates a new era in the automation system. This system integrates human-machine interface. This system can be extended using GSM. The GSM module will send the information regarding the status of crop health analysis to the respective authorities directly in case of emergencies.

We conclude that crop cultivation healthcare monitoring is done by using wireless sensor devices and report all the sensor data to the agriculturist. During the healthcare of corn crop monitoring if any parameters of the crop condition are abnormal, then send an emergency notification message to the authorities or owner by using Wi-Fi or android technologies.

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