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Remotely Operated Smart Irrigation System using Low Cost Microcontroller and Sensors

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ABSTRACT: India's population is increasing day by day, thus the demand for food is rising. Agriculture is the supreme source of food in India and is done using irrigational methods as monsoon does not fulfil the sufficient water requirement in the field. This project is aimed at improving the conventional agricultural techniques to a technologically advanced one so as to optimize the water usage and also reduces the need for constant vigilance to provide an appropriate atmosphere for better and efficient crop production. The paper presents a design of an automatic irrigation system using a low cost Arduino and Bluetooth module which can be remotely controlled through a Mobile phone. The ATMEGA328 microcontroller along with HC05 Bluetooth Module is the brain of the system and several sensors such as LDR, Op-Amp LM324 comparator are used to detect Soil moisture and light intensity falling in the field. The system is provided with a solar powered battery for power supply to make the system energy efficient. Hence the model makes the irrigation system easier, efficient and cost effective.

KEYWORDS: Smart irrigation, Bluetooth module, Microcontroller, Soil moisture sensor, LDR.

I.INTRODUCTION

According to food and agricultural organisation of united nation, the average minimum daily energy requirement is about 1800 kilocalories per person. India ranked 116, with an average daily dietary consumption of 2360 kilocalories in 2006-2008 [1]. To fulfil these enormous food requirements, agricultural field needs paramount of water for irrigation. Hence there is a necessity of smart irrigation system which closely monitors and controls the amount of water applied to the fields. The sensors employed in the system are Soil moisture and LDR which record the real time values of the physical parameters and feed them to microcontroller which are displayed on the LCD as well as wirelessly transmitted. The real time values are compared with reference values pre-fed into the microcontroller by the microcontroller for detection of motor operation [2].

The paper describes the proposed model in five sections – first one being the introduction which states the need of the system. The second section gives a brief summary of work done earlier in this topic. Details of the system are included in the third section along with component description. The fourth part states the results obtained followed by a concluding section [3].

II.LITERATURE REVIEW

Prior to this project, a lot of work has been done in this field. In one of the system, the real time values are transmitted wirelessly to the substation using ZigBee. Substation performs the controlling action on motor and irrigation valve according to preset value of moisture as set by the farmers [4]. One other system using PIC controller uses some references like T_{min} , T_{max} and Rh_{min}. Once these references are violated then controller would command to relay operating circuitry for proper controlling action [5]. Other system proposed by Chao long et.al suggested to design and implement 89C51 microcontroller based remote controlled irrigation system with Java based application for monitoring temperature, humidity of the field [6]. Another system proposes the use of microcontroller PIC18F4550, interfaced with GSM module to start the irrigation process when all parameters are within a safe range and also provides time to time feedback from ESD through SMS about the action that has taken place [7]. M. Neha Sudha suggested most

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efficient way for monitoring temperature and other parameters from fields using TDMA (Time Division Multiple Access) [8].

III.PROPOSED SYSTEM

To irrigate the fields the farmer requires water and electricity to operate the pump. Both of which are generally wasted because of manual handling. This is mainly because of two reasons- excessive irrigation of the field and when field is having rain and the pump is still supplying water to the field [7]. The block diagram of the proposed system is shown by figure 1.

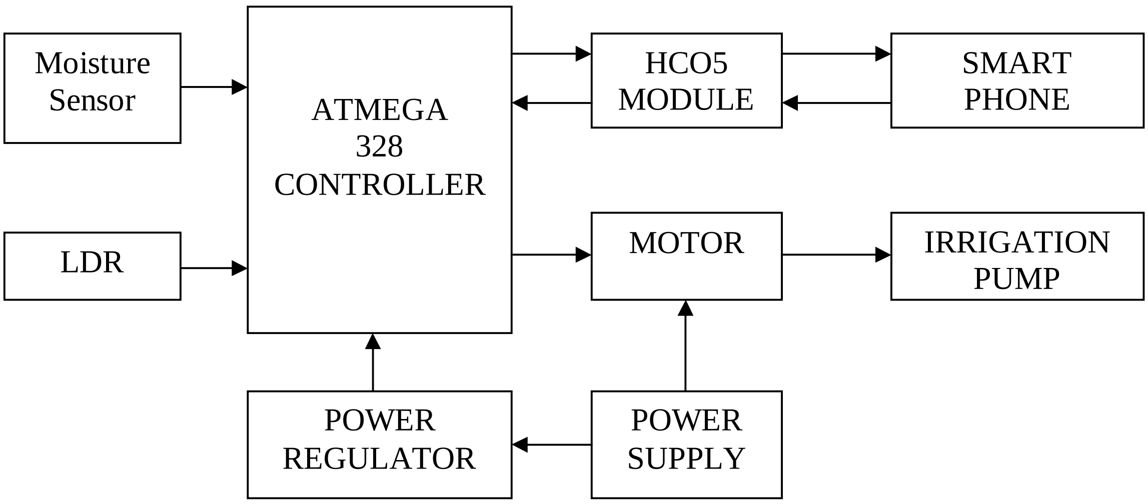

Fig 1 Block diagram representation of proposed system

A. HCO5 BLUETOOTH MODULE

HC05 is a serial port Bluetooth which is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm [9]. It is interfaced with microcontroller ATMEGA 328 and smart phone. It receives the command regarding the type of crop to be irrigated which is given by the farmer who is remotely operating the phone. The crop name along with their specific schedules is coded in the control algorithm of the microcontroller. Hence, the field is irrigated as per the schedule by selecting the desired crop name.

B. MICROCONTROLLER AND RELAY DRIVER

It is a microcontroller ATMEGA 328 based system which controls all the devices connected in the system. The soil moisture sensor, light intensity sensor are connected to the input pins of the microcontroller. The water pump and the servo motor are coupled with the output pins. If the reading of the sensor depart from predefined range the microcontroller turns on/off the pump. The servo motor is used to control the flipper’s angular position thus ensuring adequate distribution of water and sunlight to the soil. An LCD is employed which displays intensity of sunlight.

C. SENSORS

1. *Soil Moisture Sensor:* It consists of a pair of probes one of which is buried into the soil and the other is fixed at a level. As soon as the water rises to the level of the second electrode, the two electrodes are short circuited and the current starts flowing thus producing a voltage proportional to the moisture content of soil. This voltage is then

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compared by the op-amp comparator LM324 with the reference value thereby causing the motor to operate by driving the relays.

2. Light dependent resistor (LDR): The resistor whose conductivity changes according to the amount of light falling on it is called an LDR. The intensity of light is recorded and displayed on an LCD. As soon as the threshold of light intensity is reached, the flippers are operated in order to cover the field and protect the crops from high intensity of light.

IV.RESULT AND DISCUSSION

Figure 2 shows the hardware setup of the project. The microcontroller ATMEGA328 is interfaced with Bluetooth module HC05 for serial communication to select the type of crop through a remote device. Based on received data, the microcontroller schedules the irrigation according to control algorithm and generates HIGH or LOW signal to operate relay which switches the water pump ON/OFF.

Fig. 2 Hardware setup

The moisture content of soil sensed using probes inserted into the soil is compared to the predefined threshold value by Opamp comparator LM324 and in case the soil is dry, the water pump is activated by the microcontroller to irrigate the field. In case of high light intensity falling on the field, the LDR inputs the value to microcontroller which causes the dc motor to rotate to close flippers thus covering the field.

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Fig .3 LCD Displaying various status

Figure 3 shows LCD displaying various status based on the functions performed by the microcontroller. The LCD displays the crop selected with the status of pump (whether ON/OFF), if the pump is ON it shows the duration for which it will operate.

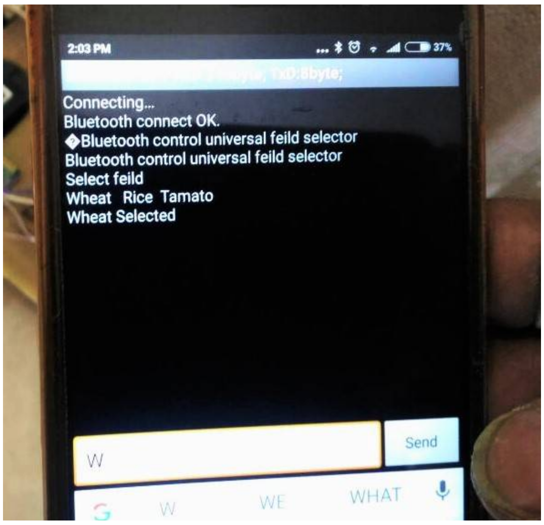

Fig .4 Selecting type of crop from smart phone

Figure 4 shows the display on the smart phone when it is connected to the system using Bluetooth module. It allows the user to select required crops. According to the crop selected the motors are operated, the duration of which had already been fed into the program.

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V.CONCLUSION

The manual control employed by the farmers to irrigate the fields is a tedious and inefficient way consuming a lot of water thereby resulting in wastage of water. Especially in dry areas where there is already scarce water in addition to inadequate rainfall, irrigation becomes difficult. Hence, the need for an automatic system which precisely monitors and controls the water requirements of the field and also protects the crops from high intensity light is witnessed. This need is met by the smart irrigation prototype described in this project. The proposed system was employed on a garden plant and tested and a significant amount of water was saved. Although the prototype is limited in the sense that large scale implementation is hard and a bit tedious. The prototype can be utilised in controlling the pest infection in plants by a little modification.

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