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Integrated Hybrid Design for Irrigation Control with Intelligent Feeder System

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Abstract

The paper proposes the design of integrated hybrid irrigation control with an intelligent feeder control system for increasing the production of crops by effective utilization of available resources. The design composes by integrating the latest technologies related to communication field. It compromises the integration of GSM, DTMF, and Keypad to AT89C52 microcontroller to configure the Feeder to supply the available resources such as water, fertilizer, pesticides, etc to the farm. The feeding can be configured for one or more time in a day at different timing or clock using RTC. The volume of the supply of water, fertilizer, pesticides can also be configured & control via a microcontroller with the help of flow measurement unit for different crops. This paper proposes the user friendly system for farmers. The farmers can provide the calibrated supply to their farms by any of this three means (GSM, DTMF, and KEYPAD). The farmers can also check the status of the feeder system through GSM.

Keywords— AT89C52 microcontroller, DTMF, flow meters, GSM, matrix keypad, RTC DS1307, solenoid valves.

1. Introduction

There are various systems developed for agriculture automation for increasing the production of crops, quality of crops, for proper utilisation of available resources. There are some wireless sensors have been implemented to check the climate conditions with various communication techniques & also system powered with solar system. This system can implement for green house as well as for open field with saving of resources [1]. Some research papers have been designed with different algorithms to analyse the problems & reducing the problems with wireless sensor network for effective utilization of resources [2]. Some research proposes the wireless sensor network communication via Bluetooth technology for real time remote monitoring of climate conditions & controlling the resources [3]. Some papers propose the monitoring of soil water infiltration using microwave radio meters [4]. Many systems are designed for automated irrigation so no need of workers on fields, only need to configure the system or tell the system about volume of available resources to be feed to the farm, also there is facility to control the EC-PH of soil by configuring the EC-PH. This system contains EC-PH sensors, flow meters to measure the flow of supplied resources. EC-PH sensor calculates the EC-PH of the soil & compares it with the feed value, if the EC-PH is not according to feed value than system makes the correction in the volume of fertiliser to achieve the rated value of EC-PH. But unfortunately the system fails where climatic conditions are unstable. Some times to achieve the required EC-PH the system take the access fertiliser than required for the field results in burning out of crops, wastage of fertilisers, in turn waste of resources & economy. This sometimes ruins the farmers completely.

The solution to above problem is the design presented in this paper. Rather than calculating the EC-PH the farmers has to just provide the information of the volume of water, fertiliser, and pesticides & on what time to be feed to the field. The farmer can configure this system from anywhere through GSM, DTMF, or KEYPAD. Also the status of the feeder, available resources & changed configuration will be replied back to farmer via a SMS. There is facility to guide the farmer for requirement of resources for different crops. The flow meter will check the volume given to field is equal to the volume configured. The sensors will check the volume of the resources available in the tanks. It tanks are empty then it should be informed to farmer to fill it up. The main advantage of this system is effective utilisation of resources.

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2.Integrated Hybrid Design for Irrigation Control with Intelligent Feeder System Design

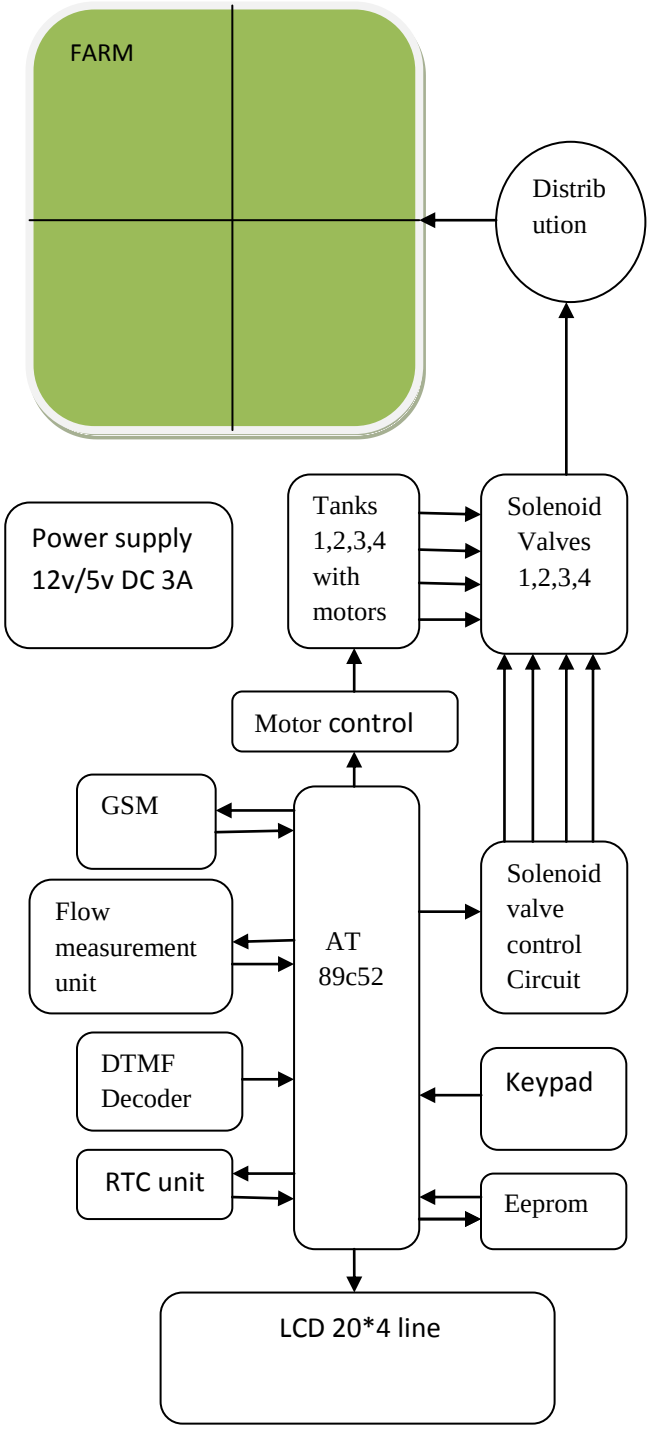

Figure1. Farm feeder configuration & control

2.1 Block Diagram description

The figure1 shows the overall structure of the propose thesis. The unit consists of GSM Sim300 module to configure the system via SMS & also the status will be informed to farmer via GSM modem. The next unit is DTMF decoder; this system can also be configured via telephone but only the requirement is the phone must be in auto pick-up mode. The system can also be configured manually via a keypad.

The RTC provides the day, date, time so that one can configure the feeder time. The display unit is used to show the status of each activity carried out. The motor control block switches the motor on/off. Solenoid valves are used to control the flow of supply. The flow measurement unit measures the volume of the resources feed to field & give pulse output to microcontroller unit which help to provide the required supply. EEPROM is used to save the configuration. Tank is used to store the resources. The microcontroller is the heart of system. All controlling action will be carried out by this unit.

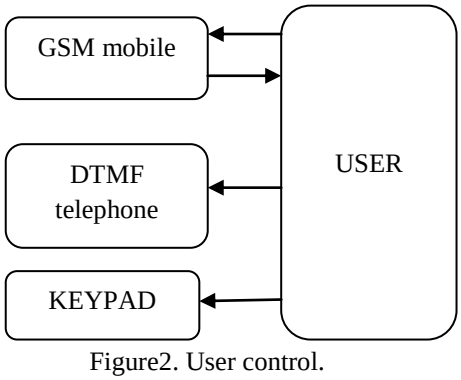

Figure2. User control.

The figure2 show the structure through which the user can configure the system. It shows the number of ways through which the farmer can give the input to the system for required output. The input to the system can be configured via a SMS through mobile handset. This system also has the facility to check the status via SMS. Next block is DTMF telephone. This system can also be controlled via telephone just to call from anywhere and press the numbers on the telephone keypad. If the user is on the field then there is no need to call or to send the SMS so to configure the system the user can input the data via 4*4 matrix keypad.

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3.Integrated Hybrid Design for Irrigation Control with Intelligent Feeder System circuit Design.

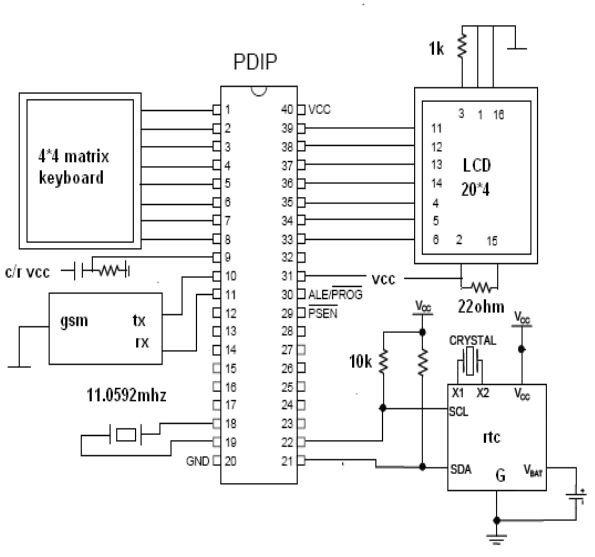

Figure3. Circuit for farm feeder configuration & control

Figure3 shows the part of schematic for feeder control. The 4*4 matrix keyboard is interface with AT89C52 to port1. GSM module to port3 pin p3.0 & p3.1 RX & TX respectively. The GSM AT commands are used to configure the module. A liquid crystal display 20*4 lines is interface at port0 in 4-bit interface mode. Note that the 10kohms pull-up will be required at port0 not shown in schematic. At pin no.9 the power on reset circuit is interface which consists of one resistor of 10kohms & a capacitor of 10microfarad/25v. Pin 18 & 19 are connected to external crystal of 11.0592 MHz frequency. This frequency is selected to generate error free baud rate for serial communication at 9600 bits/sec rate. The pin 31 is strap to VCC so as to access the code from AT89C52 internal memory. The RTC DS1307 is connected to port2 pins p2.0 & p2.1 serial data & serial clock which is i2c interface for saving the configuration. The schematic given in figure3 works on 5vDc supply only solenoid valves, relays & flow meters requires 12vDc supply. The user operating this system will also have an option for to select the way through which the input is to be configured for required output. RTC also has some memory so EEPROM shown in block diagram is optional one. The output from flow meter is connected to pin no. 12, 13, 23, 24 is pulse input to microcontroller which will measure the volume of the flow. The microcontroller will compare the outgoing volume with configured volume & control the valves & motors.

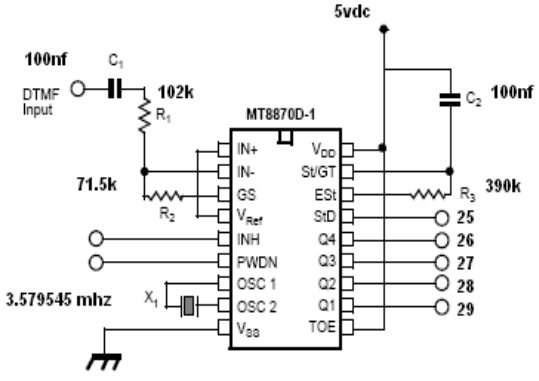

Figure4. Circuit for DTMF interface with AT89C52

The figure4 shows the typical schematic of DTMF decoder 8870 interfaced to AT89C52 microcontroller. This circuit is interface to pins 25, 26, 27, 28, 29 of port2. The user can also configure the system by this circuit. Circuit works on 5vDc supply.

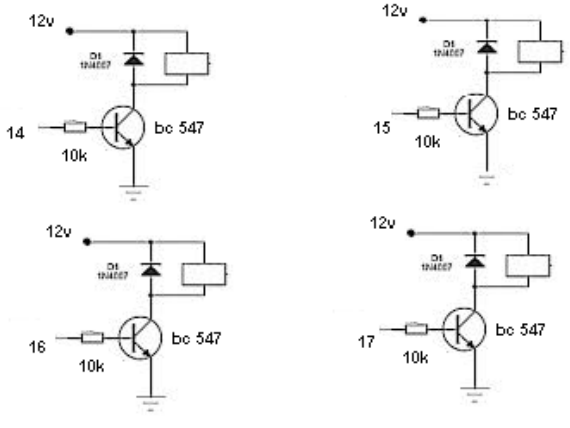

Figure5. Relay interfacing with AT89C52

Figure5 shows the schematic of relay interface with microcontroller to port3 pin no. 14, 15, 16, and 17. This relays works on 12vDc supply & the current consumption is depended on resistance of coil. The relays are used to turn on or turn off the solenoid valves & motors. Here in this schematic the NPN transistors BC547 are used to activate or deactivate the relays. Here the fixed bias circuit is used. The resistor of 10kohms is used to bias the transistor ay 0.7v for 5v input. The transistor works in saturation & cut-off mode.

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4. CONCLUSION

Using this system the farmers can be able to utilise the available resources efficiently without wasting of resources. This system gives accurate volume of output of water, fertiliser, and pesticides to the farm. No need to calculate the EC-PH. The user can also feed the input by any of the three means given & from anywhere of the world via GSM, DTMF, KEYPAD. This system can be implemented for any field, farm, green house, for any type of crops.

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5. References

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