Research Paper

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Wireless Irrigation System for Rural India using Zigbee/X-bee

Engineering

KEYWORDS : Zigbee/X-bee, Relay Drivers, Temperature Control Sensor.

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ABSTRACT

Indian economy is mainly based on agriculture. The most important parameter for the agriculture is timely and sufficient supply of water. Most of the farmers are dependent on electric water pumps for irrigation which demands electricity. The frequent, intermittent, low voltage supply of power to the agriculture sector has caused problems to the farmers who are spending their time monitoring the supply of power without which their work cannot start. In this paper we will be focussing on implementing the switching of the motor used for irrigation purposes in rural India using the technology X-bee/Zigbeetransreceiver and Relay Drivers.

Introduction

In recent years, traditional control systems have been given up, and adaptive and intelligent control

systems have been used instead .Toward the end of the 20th century, development in electronics, power electronics, and computer technology has started new progress in control technology and automation. Controlling of electrical motors used in various systems and process control, especially the induction motors, became very important because of its suitability in system design in industry and its many other advantages such as energy, time, and sensitivity.

For the last few years, we've witnessed a great expansion of remote control devices in our day-to-day life..Zigbee operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in most jurisdictions worldwide. Induction motors are very popular in industrial applications because of their simple and safe structures.

The X-Bee module used in the proposed system is X-Beeand X-Bee-PRO ZB embedded RF module because it can be easily customized and programming can be directly on the module which eliminates the need of extra processor.It has the range of around of 2miles(3200 meters) and frequency of 2.4Ghz with serial data rate of 1200 bps-1 Mbps.

Problem Statement

India is the country of agriculture. Most of the people of India live invillages and are fully dependent on agriculture. The heart of the agriculture is irrigation. Most of the farmers are dependent on tubeWells for irrigation and supply of power to agricultural areas is limited to only a fixed hour in a day which is not predictable always. The frequent power cuts and low voltage supply create big hurdle to the farmer and thus it needs continuous manual monitoring. Lately, there has been significant interest as regards electrical monitoring.Additionally, several studies have been carried out to monitor electrical changes and lots ofwork has been done for this. The object of our system is to provide a solution for these problems. By using this proposed system a farmer can monitor power on/off anywhere using the proposed system and he can switch on or off the motor from anywhere far from the actual field.There are many problems associated with irrigation :

- They both consume much time and need regularity.
- Normally farms are so far from the house so, irrigation needs traveling which causes
- Inconvenience and fuel consumption.
- Irregularity of power supply may lead to do irrigationat odd timing.
- Pesticides are harmful to the farmers because they arepresent in the field when pesticide is sprayed.
- The problem of thieves/robbers/ antisocial elementsat the field is also significant.
- Possibility of the presence of venomous creatures.

ZIGBEE NETWORK PROTOCOL

- The focus of network applications under the IEEE 802.15.4 / ZigBee standard include the features of lowpower consumption, needed for only two major modes (Tx/Rx or Sleep), high density of nodes pernetwork, low costs and simple implementation. These features are enabled by the following characteristics :
- The number of channels allotted to each frequency band is fixed atsixteen (numbered 11-26), one (numbered 0) and ten (numbered 1-10) respectively. The higher frequencyband is applicable worldwide, and the lower band in the areas of North America, Europe, Australia andNew Zealand.
- Low power consumption, with battery life ranging from months to years. Considering the number ofdevices with remotes in use at present, it is easy to see that more numbers of batteries need to beprovisioned every so often, entailing regular (as well as timely), recurring expenditure.
- In the Zigbeestandard, longer battery life is achievable by either of two means: continuous network connection andslow but sure battery drain, or intermittent connection and even slower battery drain.

PROPOSED SYSTEM MODEL:

In this system we had focused basically on switching an irrigation motor ON/OFF wirelessly from house of the farmer, with this project we look forward in solving the above mentioned problem from agriculture.

In a recent study, it was found that the average distance of farmer's house to his field is around 2km. approx. Our system deals with a range of approximately 3200 metres.

A switching device basically a box which incorporates any embedded system capable of sending only two values ON & OFF respectively, this switching box is installed in farmer's house, which in turn is connected to a zigbee/x-bee Tranreciever whichwirelessly transmits to a base station by using XBee-PRO technology [1].

The base station sends the control signals to the field station by same technology.

IV.BASE STATION

The base station or the irrigation site, mainly comprises of the following components:

- X-bee/zigbee transceiver pair
- Temperature sensor(LM3580)
- Relay and relay driver or simply a motor driver IC- L2939NE.
- IRRIGATION MOTOR
- MICRO-CONTROLLER (say ARDUINO-UNO)
- LCD FOR MONITORING MOTOR TEMPERATURE

V- WORKING

When the RF-signal from the house for making the irrigation motor ON/OFF through zigbee, these signals are then intercepted by the receiver present at the base station, the RF-signals are then intercepted by the micro-controller arduino. The arduino then processes the input command, then with the help of relay, it gives the switching commands to the motor.

There are two relays used in the proposed system, the first one simply drives the motor ON/OFF, while the other has the important aspect of turning the valves for the emission of water. Thus, the motor can be made wirelessly on/off. Also, the temperature of the motor can be continuously monitored using the temperature sensor.

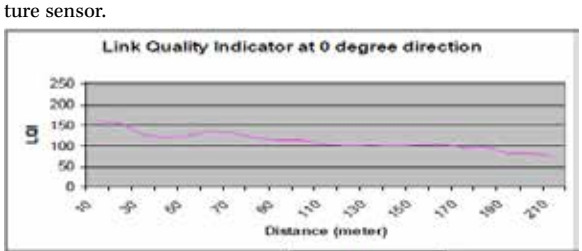


FIG.1 LINK QUALITY

The output of the microcontroller is then used to control the relays through a relay driver ULN 2003 shown in **Fig 4.** It is used to fulfil the relay's current and voltage requirements which a microcontroller cannot give.

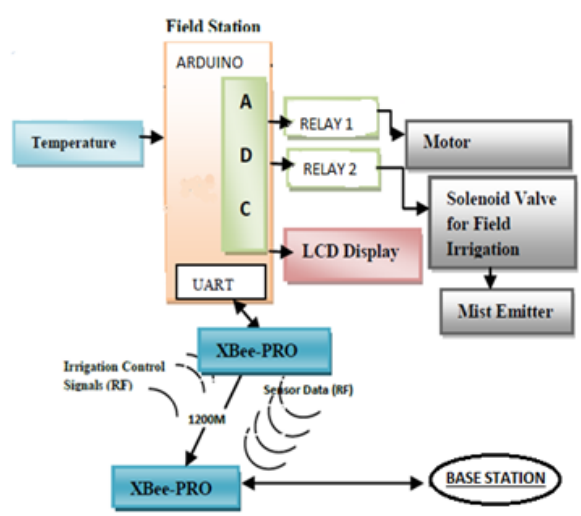
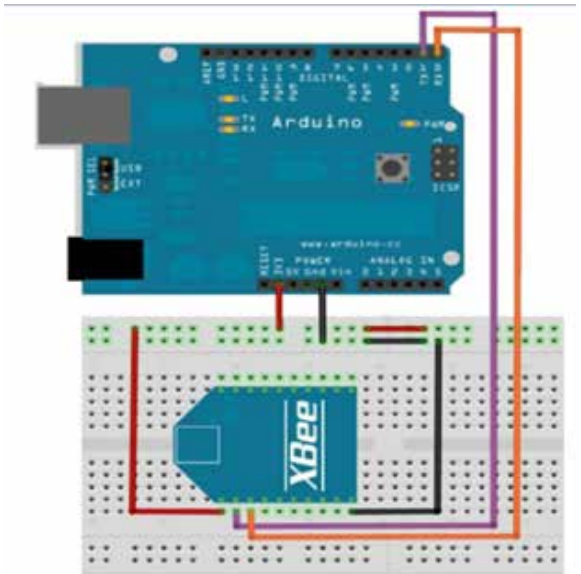


FIG.2 GENERAL WORKING PROCESS

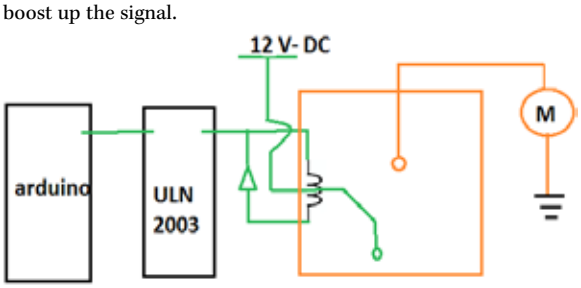
FIG.3 CONNECTION OF X-BEE WITH MC



ULN-2003A/*5]*is a high voltage,high current Darlington transisitor, such that:

$\beta = \beta_1 + \beta_2$

The fig.1 clearly depicts **[7]** that the, signal quality continuously degrades as the distance of the link increases, this problem might be overcome by applying repeaters in between, that will boost up the signal.



VI-ROAD AHEAD:

At present, the system proposed in this paper can fully solve the switching aspect of irrigation motor, as well in future it can be applied to the rural area of our country, the demerit with it is range of communication. This can be mitigated by applying repeaters and if few bands will be allocated for use by TRAI(Telecom regulatory authority of India).

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