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AUTOMATIC WATER LEVEL CONTROLLER BASED ON RADIO FREQUENCY FOR RESIDENTIAL APPLICATIONS

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ABSTRACT

Water and energy are the two-essential explanation of worry in this day and age. With the increase in population, the demand of both energy and water are expanding. To lessen the wastage of these two fundamental assets and to spare time on automated water pump has been structured, including modest electronic devices like RF module, relay, sensor etc. In this paper we have discussed about design and implementation of water level control system which is wireless, automatic, cost effective and reliable. This is used keep on observing the tank water level to switch off the motor once it is switched on. It uses transmitter module which is installed at tank and receiver module installed at the motor. Radio frequency (RF) based transmission and reception system used to remotely monitor and control the water Level of an overhead tank placed up to 10 meters to 500 meters according to our need. As the distance is increased by varying the height of transmitter and receiver antennas.

Keywords*: Encoder, Decoder, Radio Frequency Module, Relay, Sensor, Solar Panel.*

I. INTRODUCTION

Maintainability of accessible water asset in numerous areas of the world is currently a predominant issue. This issue is unobtrusively identified with poor water portion, wasteful use, and absence of sufficient and integrated water management.[1] Water is generally utilized for farming, industry, and residential utilization. In this way, effective use and water observing are potential imperative for home or office water management system. Over the most recent couple of decades a few observing frameworks incorporated [2] with water level identification have been acknowledged. Estimating water level is a basic undertaking for government and home point of view.

Water from key channel is pumped up to the tanks using electrical water pump [2]. In this paper a circuit is designed which can make this system automatic, i.e. it switches ON the pump when the water level in the overhead tank goes low and switches it OFF as soon as the water level reaches a pre-determined level. Water Level Controller employs a mechanism to detect and maintain the water level in a tank or any other container by switching it ON/OFF the motor automatically when needed. Hence this water level controller is one of the least expensive and easiest way which decrease the wastage of both power and water. Following are the objectives of the research project to ensure it meets the aim:

1.The Range is varied with the help of transmitter and receiver antenna height.
2. Solar panel is used for regular transmitter DC power supply.

II. LITERATURE REVIEW

To supply the water from ground level to the overhead level is accomplished by a motor which runs on electrical power. So, in a manner we have diminished human endeavors for this kind of work yet on cost of electrical power. But there are some issues with this kind of plan. Firstly, when the overhead tank goes full there is no control framework to turn off the pump. This prompts wastage of water on housetop which additionally may cause housetop drainages. To avoid these problems, we need some sort of control arrangement which could control the switching section of motor based on level of water in the tank. Wireless medium for transmission and reception is used which includes RF modules and water level sensor. Water pump is connected with a relay circuit. Circuit is consisting of level sensor, encoder, RF module, decoder, relay, pump. Paper [3] design and develop a wireless water level

conditioning system using point-to-multi-point RF communication technology. That project to ensure it meets the aim to know the sensing equipment for measuring water level. Paper [4] indicates to control the corporation water supplying for several areas from one control board. In that project. Arduino board is used for controlling the System. Paper [5] includes the processes switching on the pump when the tank is empty and switching the pump off when the tank gets full so that no water is wasted and the hole system will wireless. The receiver circuit will not use a bulky transformer that's why the entire system is very light weight and also low cost.

In this paper a radio frequency (RF) based transmission and reception system is used to remotely monitor and control the water Level of an overhead tank. The range or distance up to which the motor can be control is based upon the variation of antenna height. The level sensor is used to sense the water level in the overhead tank. Further signal is encoded by encoder (HT12E) and that signal is transmitted by RF transmitter (RF-434MHz) and received by RF receiver. The decoder (HT12D) decodes the signal received from RF receiver (RF-434MHz) and gives input signal to the relay. Relay is used in controlling the motor operation.

III. METHODOLOGY

This system consists of two main parts that are RF module and water level sensors. The level of water in the overhead tank is being monitored and the system automatically switches the pumping machine on to pump water into the overhead tank and then switches off when the water is full. Using this system, one can remotely monitor and at the same time control the water level of an overhead tank by the variation of antenna height. The distance or range of water tank from the motor control is varied by increasing the antenna height. The continuous dc power supply to transmitter module is given by using the solar panel. The flow of water from the tank is detected by the mechanical float ball sensor. The signal from the sensor is then forward to the encoder and then encoder encode the data with address and feed to the RF transmitter. The serial data from the encoder is given to RF transmitter which converts the data to the analog form so that the data is transmit to the helical antenna.

At the receiver side, the address of the signal that is send from the transmitter side should be matched with the receiver module. If the address is matched with the transmitter module, then data is received by the RF receiver and feed to the decoder. The decoder will decode the data same like that of encoder side. Then the data is given to the motor or appliances that we want to switch on and off automatically. The motor is controlled by using the relay. The distance or range between transmitter and receiver module is varied by increasing and decreasing the antenna height. The height of the antenna at transmitter side which is fitted at the water tank should be equal to the height of antenna at receiver side which is fitted with the motor. So if the water tank is the top floor, the motor which is at ground level is automatically switch on and off depend upon the variation of antenna height.

IV. EXPERIMENTALPROCEDURE

For this experimental set up, the basic components used are shown below. It consists of level sensor, encoder, RF module, decoder, relay, pump. The sensor is used to detect the flow of water level in tank.

Encoder

HT12E is an encoder IC for remote control applications. It is commonly used for radio frequency (RF) applications [6]. By using the paired HT12E encoder and HT12D decoder we can easily transmit and receive 12 bits of parallel data serially. HT12E simply converts 12-bit parallel data in to serial output which can be transmitted through a RF transmitter. These 12-bit parallel data is divided in to 8 address bits and 4 data bits. By using these address pins, we can provide 8-bit security code for data transmission and multiple receivers may be addressed using the same transmitter. Figure 1 shows the pin diagram of encoder.

Decoder

HT12D decoder will be in standby mode initially ie, oscillator is disabled and a HIGH on DIN pin activates the oscillator [1]. Thus the oscillator will be active when the decoder receives data transmitted by an encoder. The device starts decoding the input address and data. The decoder matches the received address three times

continuously with the local address given to pin A0 – A7[6]. If all matches, data bits are decoded and output pins D8 – D11 are activated. This valid data is indicated by making the pin VT (Valid Transmission) HIGH. This will continue till the address code becomes incorrect or no signal is received. Figure 1 shows the pin diagram of decoder HT12D.

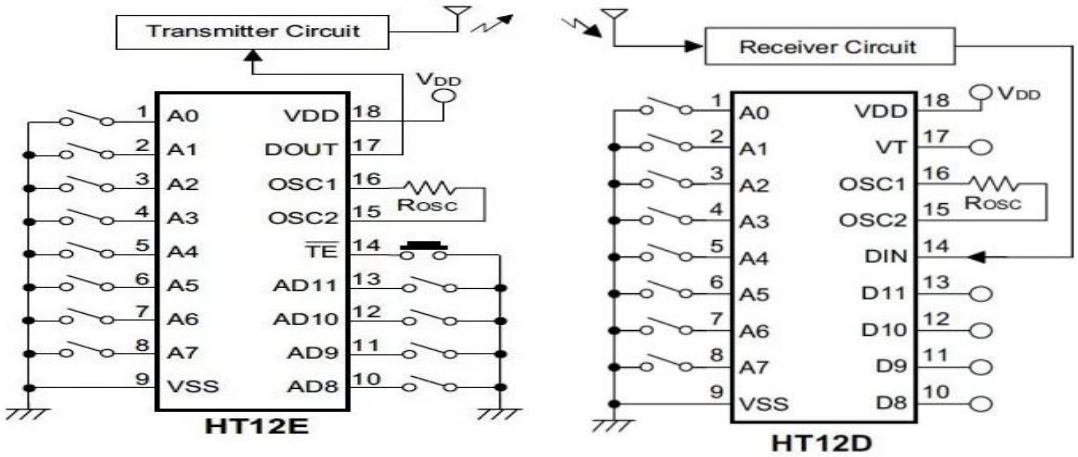

Figure 1: Pin diagram and connections of Encoder and Decoder

Relay

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. A type of relay that can handle the high power required [4,7] to directly control an electric motor or other loads is called a contactor. There are several relays used for different applications. We are using a 12v relay for our circuit.

RF Modules

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of sight mode [8], RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter [9] and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The RF module of transmitter and receiver is shown in figure 2. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

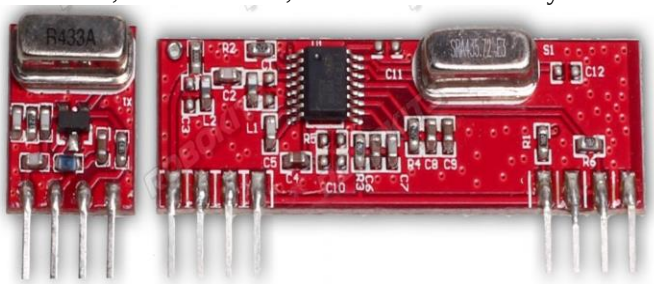

Figure 2: RF module of transmitter and receiver

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V. BLOCKDIAGRAM

The block diagram of the project shown in figure 3 depicts that at the transmitter module the power supply is given by solar panel. The mechanical ball float sensors senses the water level of the tank when it is full and give the signal to the encoder which transmit the encoded data to the transmitter RF module. The data is then transmitting to the helical antenna.

At the receiver side, the signal from transmitter antenna is matched with the receiver antennas which decode the data at the decoder. The data is then given to the relay which on and off the motor or appliances.

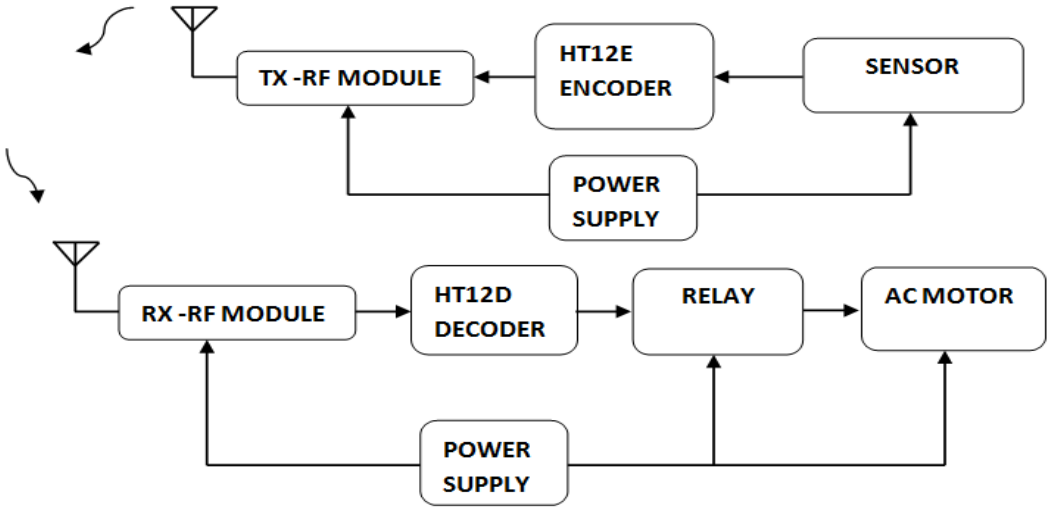

Figure 3: Block Diagram of automated water level controller

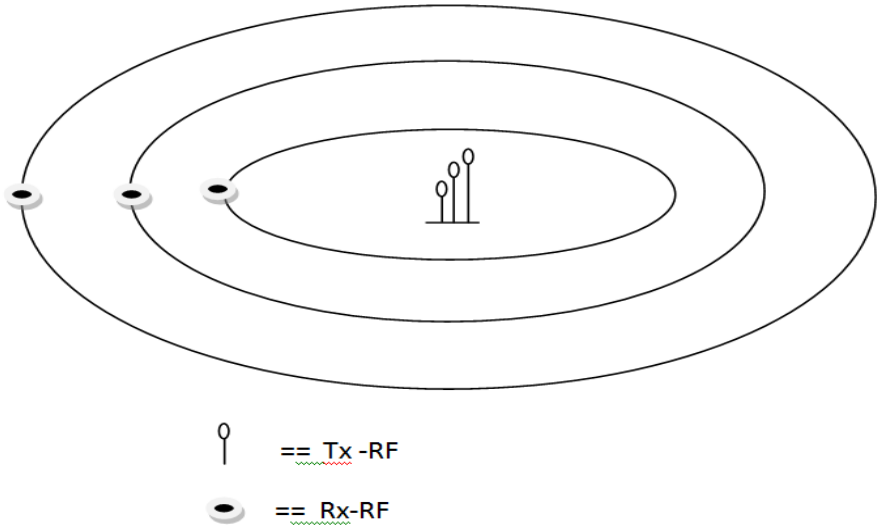

Figure 4: Radiation pattern of transmitter and receiver module

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VI. FLOWCHART

The below flow chart shows the actual process of the system how the values are calculated.

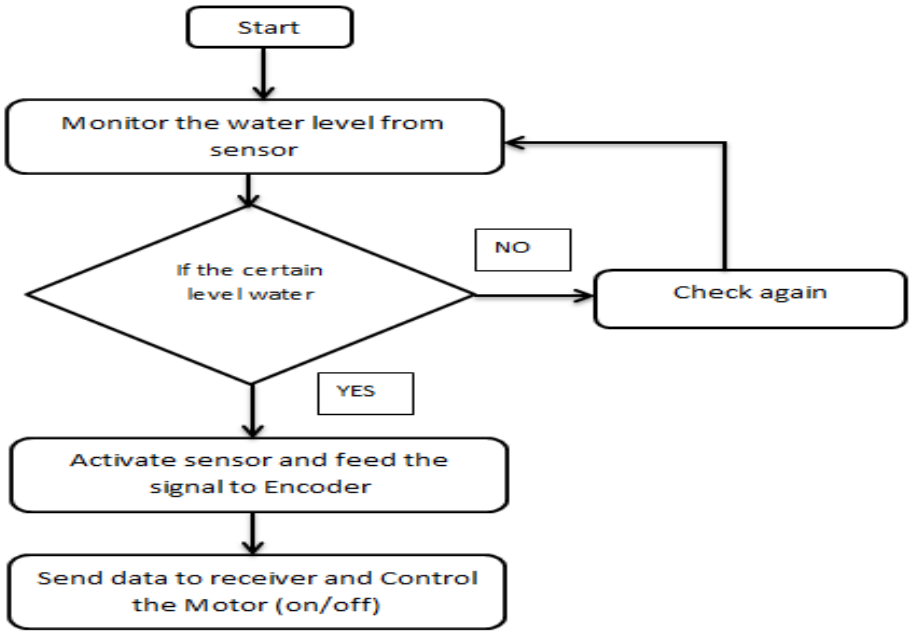

Figure 5: Flow Chart of the system

VII. CIRCUIT DIAGRAM

The interfacing of the transmitter and receiver module with the encoder and decoder is shown in figure. The connections of the sensor, relay and antenna are display in the circuit diagram shown in figure 6.

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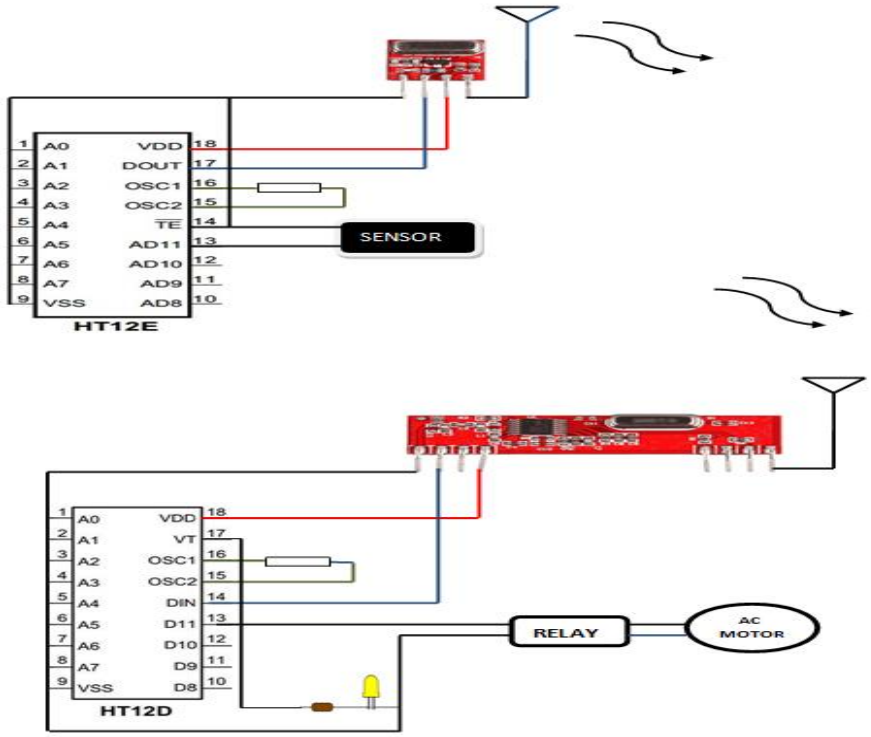

Figure 6: Circuit Diagram of the project

VIII. IMPLEMENTATION SETUP

This system contain two section first is transmitter and second receiver. A mechanical ball float sensor is connected at transmitter side, when water levels at certain point the sensor active and send the signal to receiver. At receiver side decoder IC decode the signal and operate the relay which is connected with water pump. According to signal the motor will be on/off. The solar panel is attached at transmitter side for give the regulator supply to transmitter components (Tx-module, encoder and sensor) using rechargeable battery. We can do operate all application at home by using RF module with change the address of single transmitter module and varied the height of antenna. The implementation set up of the project is shown below in figure 7.

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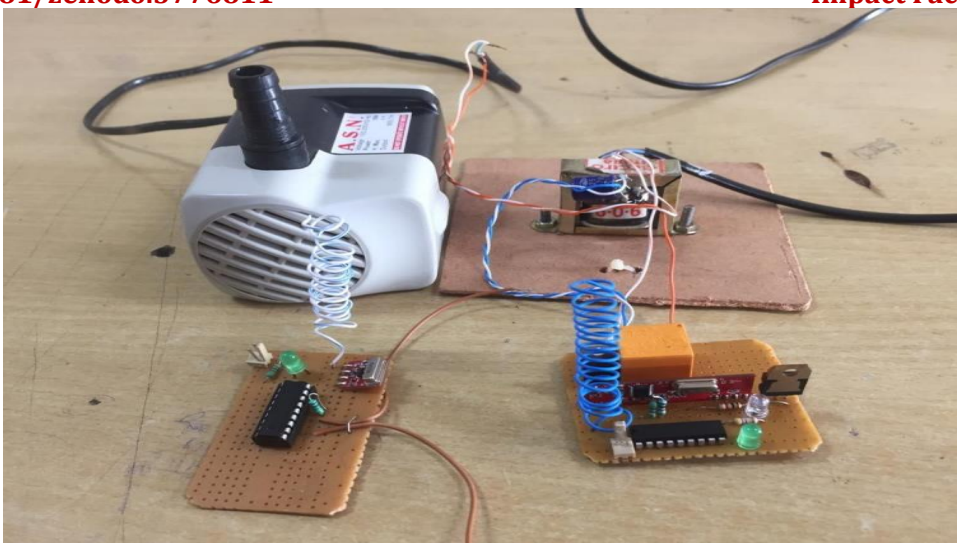

Figure 7: Implementation of the water detection system

IX. CALCULATIONS

With the variation in the height of the antenna, the range is increase or decrease according to our requirement. As we increase the antenna height from the transmitter module, the range to catch the signal at receiver module is increase with same antenna height at receiver side. Calculations regarding the variation of antenna height are given below.
Frequency (f) = 433MHz
Wavelength (λ) = c/f
As c = 3 x 10^8 m/s
λ = c/f
λ= 3 x 10^8 /433 x 10^6
λ = 69.2 cm
Height of antenna (H) = λ / 4
H =69.2 / 4
H = 17.25cm (Max.)
Using above formulas, value of antenna height in comparison with range are given below in table 1:

Table 1: Readings of height of antenna and Range

S.No	Height of antenna(cm)	Range (m)
1	Without antenna	10
2	3	50
3	5	110
4	7	180
5	10	320
6	12	395
7	15	445
8	17.5	485

X. RESULTS

The experimental results of the system show that as the height of the antenna at the transmitter module is increased which is fitted at water tank, the range of the signal at the receiver side is increased which is fitted at motor. This means if the motor pump is at ground level, the range of the signal transmitted from the water tank is maximum up to approximately 500m through which the signal at receiver side is received. The height of the antenna at transmitter side should be with the same height at the receiver side.

XI. CONCLUSION AND FUTURESCOPE

With the variation of the antenna height of both transmitter and receiver which is placed at water tank and motor respectively, the range or distance is increase or decrease. With the use of this project, there is automated control of the motor with the level of water in the tank which save the water. The continuous power to the transmitter module fitted at the water tank is given by using the solar panel. This paper depicts that there is control on the wastage of water with this automated system. The whole framework is progressively practical and implemented. In the future scope, there is possibility to increase the distance or range by using different size and type of antennas.

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