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Smart Water Saver using Ping Sensor and RF Communication

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Abstract— **Water is the most important one in our day to day life. Wastage of water causes the water shortage problem in human being life. The proposed system is smart water saver using ping sensor and RF (Radio Frequency) communication. This paper saves the water overflow from overhead tanks. It consists of ping sensor, Microcontroller, opto-coupler, relay, buzzer, and regulator, RF Transmitter, Receiver and Led (Light emitting diode). If the water reaches the maximum level of overhead tank, the motor is switched off and red led is turn on. When the water level is reduced to pre determined level (low level), then the motor, Green led and Buzzer also turn on. Suppose underground water level is very low, the water is cannot pump to overhead tank. In this case Motor is turn off automatically with help of water sensing wires and provides beep sound continuously. In this time we are switch off the unit supply manually. So we are avoid unnecessary running of motor and also prevents the damage of motor. The source of reservoir is bore well water or Corporation water tape at our home.**

Keywords: **Water level controller, Ping Sensor, Dry running preventer, Overflow controller.**

I. INTRODUCTION

Water is the very important nature's gift for human beings. Without water there is no life for human beings, animals and plants on our earth. Generally peoples are switch on the motor for filling the overhead tank and forget to switch off the motor after filling of water. This makes wastage of water and also shortage of water. Sometimes underground tank is empty, but still running of pump motor is gets damage. In order to avoid this wastage of water and damage of motor, we are proposed this article. Whenever water is reach the full level at overhead tank, the motor is automatically cut off. Now Red led is turn on and buzzer gives sound for few seconds. So water overflow is avoided and also avoid the free running of motor when the water level is low at reservoir with help of water sensing wires. When the water reaches the pre- determined level (low level), at overhead tank, the motor is automatically switch on. It was indicated by Green led and buzzer sound. After reaching the full level, motor is automatically turn off. This process is repeated forever. This design is dependent of microcontroller and also small in size [1]. So it can be employed in apartments, industries, colleges, farms and hospitals.

II. BLOCK REPRESENTATION

The block representation of the proposed Smart Water Saver using Ping Sensor and RF Communication is shown in Fig.1.and Fig.2. In this proposed article consists of two block diagrams. First block diagram represents transmitter section and second one represents receiver section. Transmitter section includes Ping sensor, Microcontroller, Encoder and RF Transmitter. A Ping sensor detects the water level and sends it to microcontroller. Microcontroller processes the given signal and gives the decision to Encoder. It encodes the signal from microcontroller and gives to the RF transmitter data pin. Finally data's are transmitted through air medium. In this proposed article Arduino Nano board is used as microcontroller.

Receiver section includes RF Receiver, Decoder, Relay driver, Motor and Led's. RF receiver receives the transmitted signal from air and gives to decoder section. It decodes the given input signal from RF receiver and output of decoder is given to relay driver circuit, buzzer and led's. Motor activation is decides by water levels in water tank and this motor is driven by relay driver circuit. So this article is useful to control the water overflow and prevent empty water tank.

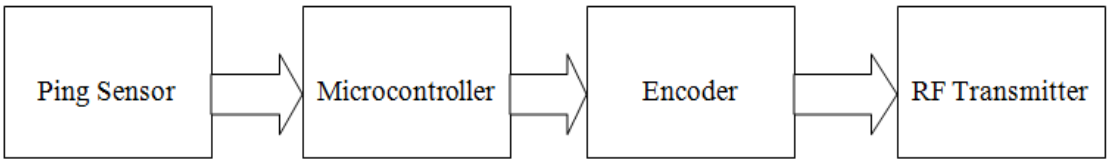

Fig.1. Block representation of the proposed system transmitter

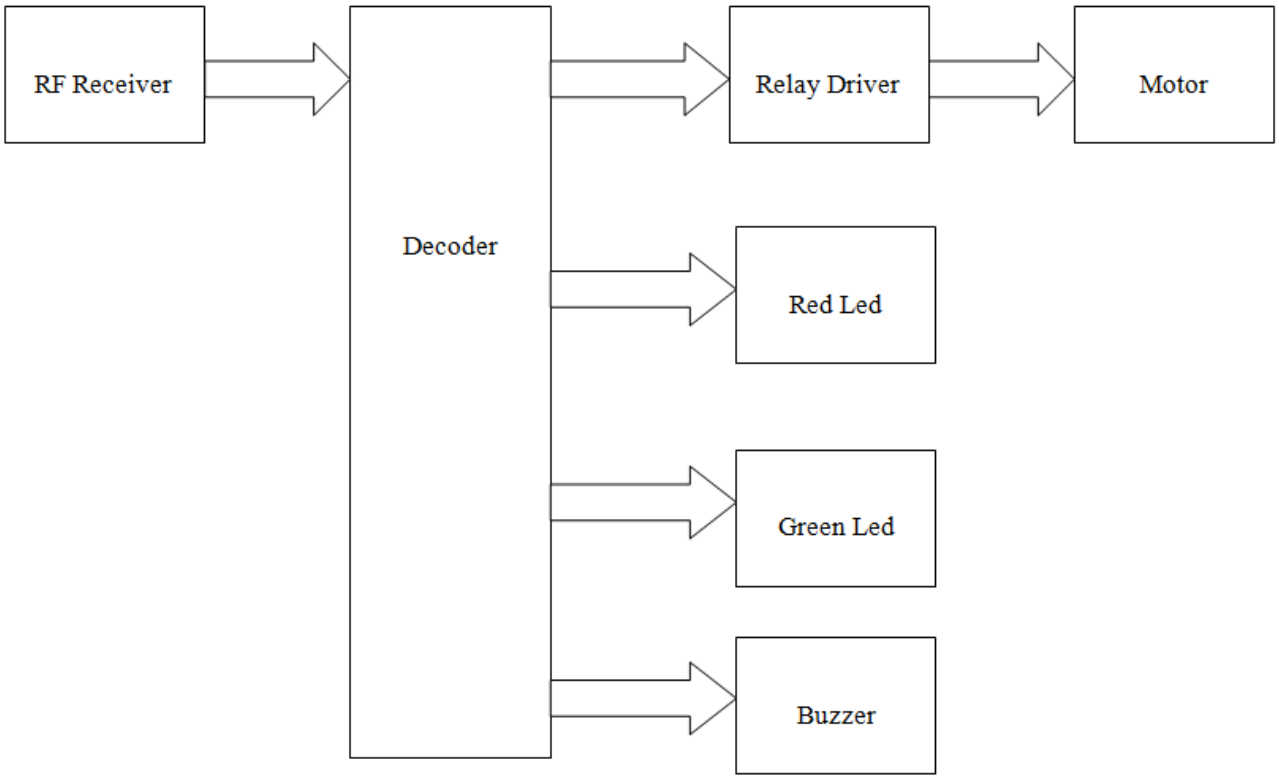

Fig.2.Block representation of the proposed system Receiver

III. HARDWARE IMPLEMENTATION

The hardware details of the proposed Smart Water Saver using Ping Sensor and RF Communication is detailed below.

a) Arduino Nano

Arduino Nano board is an open source board from Arduino company. This board consists of Atmega328p controller, 14 digital I/O Pins, 8 analog pins, 32KB of flash memory, 2KB of SRAM and 1KB of EEPROM. This board is operating at 5V Direct Current (DC) and input voltage is 7-12V DC. Compare to arduino uno, this board is compact in size and hence it occupies the very low space in water tank. This board is programmed by arduino 1.6.5 software from Arduino Company. In this software Embedded C code is used for programming purpose [2]. This software includes serial port option for monitor the output status in computer with different baud rates. In this proposed system we are using 9600 baud rate for output monitoring purpose. After programming we are disconnecting this board from computer and give external supply from battery or power adaptor. In this board, atmega328 controller is soldered on circuit board. So this controller is cannot remove from this board and fix into another general purpose Printed Circuit Board (PCB) board. This is one of the drawback when compare to Arduino uno board.Arduino Nano board is shown in Fig.3.

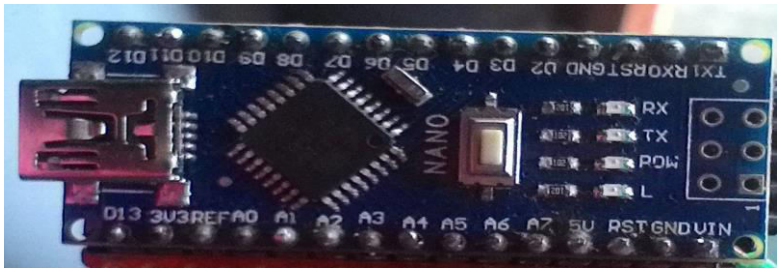

Fig.3.Arduino Nano

b) Ping Sensor

In this proposed system we are using ultrasonic sensor HC-SR04 to measure water distance in water tank [3]. This sensor consists of ultrasonic transmitter, receiver and control circuit. It provides the sensing ranges from 2cm to 400cm non-contact measurement function. This module automatically sends the eight 40 kHz signal and detects the return signal when the obstacle is present in this travelling path. Distance of the object is measured using this transmitted and received signal time variation. Formulae used for this calculation is distance= (high level time × velocity of sound (340m/s) /2). This module contains 4 pins

namely VCC, Trig, Echo and GND. So this module is very easy to connect controller to use it ranging. Ping Sensor is shown in Fig.4.

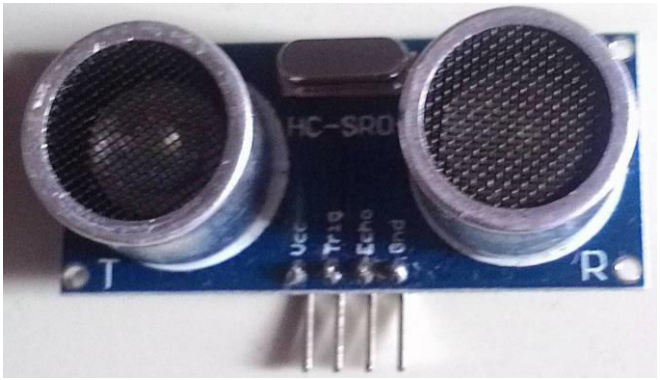

Fig.4.Ping Sensor

c)Encoder

Encoder is used to convert 12 bit parallel input data into serial output data [6]. These 12 bits are classified into 8 address lines and 4 data lines. These address lines are used to give security for our data transmission. Operating voltage of this encoder is 2.4V to 12V and it consists of inbuilt oscillator. This encoder IC (Integrated Circuit) is totally consists of 18 pins [4]. Encoder IC pin diagram is shown in Fig.4. Out of these 18 pins, pin 14 is used to allow data transmission. This pin is called transmission enable. When we are transmit the data, must give active low signal to this pin. If it is not active low, then data is not transmitted. In this proposed system we are using two loads only. So data input is given to pin number 12, 13 and remaining two pins are left. Output of serial data is taken from pin 17 and given to RF transmitter module. Encoder IC is shown in Fig.5.

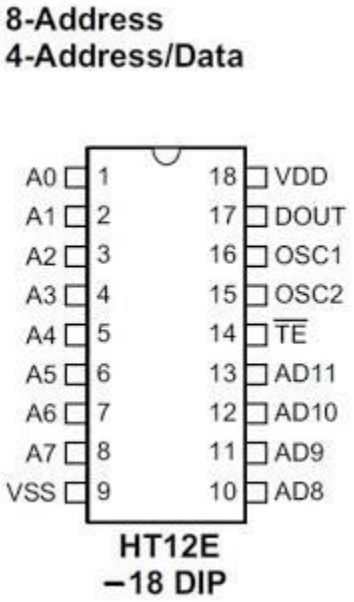

Fig.4. Encoder IC Pin details

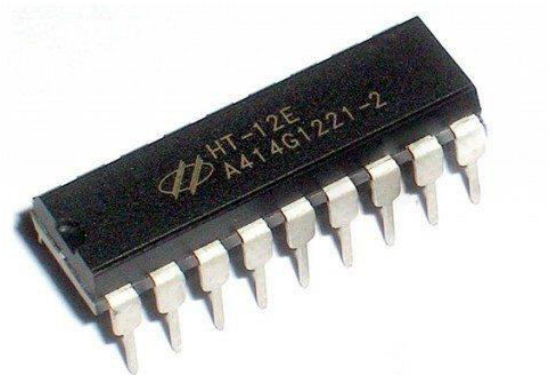

Fig.5.Encoder IC

d) Flowchart

A basic flow diagram of Smart Water Saver using Ping Sensor and RF Communication is shown in Fig. 6.

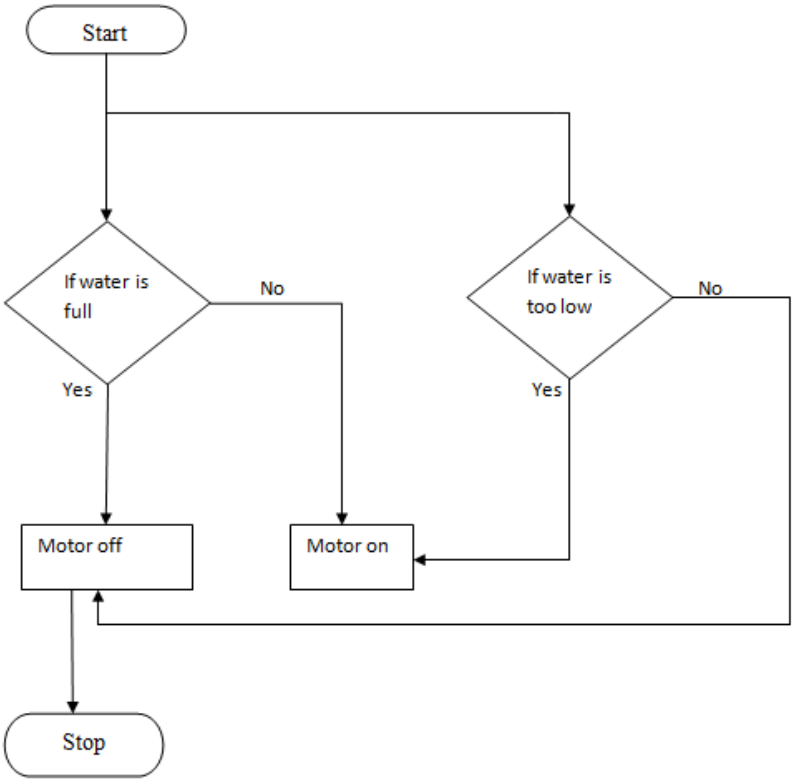

Fig.6. Flowchart for Smart Water Saver using Ping Sensor and RF Communication

e) Decoder

Decoder is used to convert 12 bit serial input data into parallel output data [4]. Decoder IC pin diagram is shown in Fig.7. These 12 bits are classified into 8 address lines and 4 data lines. These address lines are used to give security for our data reception. Operating voltage of this encoder is 2.4V to 12V and it consists of inbuilt oscillator. This decoder IC (Integrated Circuit) is totally consists of 18 pins. Data output is taken from pin number 12, 13 and

remaining two pins are left. Data output from RF receiver is given to pin 14 of decoder. Then it converts serial data into parallel data. Decoder IC is shown in Fig.8.

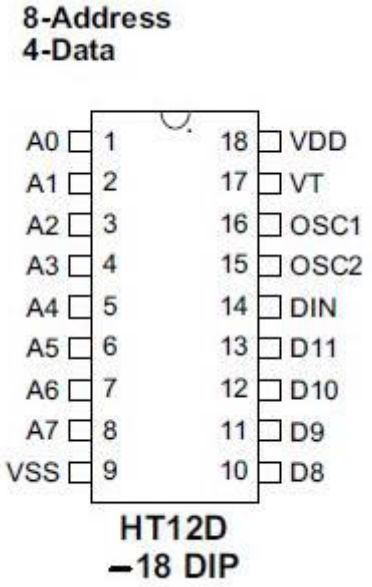

Fig.7. Decoder IC Pin details

Fig.8.Decoder IC

f) RF Transmitter

In this paper we are using RF transmitter module for transmitting the data's through air [5]. Output from encoder section is given to RF transmitter DATA pin. Operating frequency range of this transmitter is 433MHz. Amplitude Shift Keying (ASK) modulation is used in this RF transmitter. This module consists of four pins namely VCC, GND, ANT and DATA. RF signals can travel even obstacle is present in path of RF waves. The transmitter output is 8mW at 433.92MHz with range of 400 feet open area. Indoor range is 200 feet and goes through most walls. This module accepts both linear and digital inputs can operate from 1.5V to 12V Direct Current (DC), and makes building miniature hand held RF transmitter is very easy. RF transmitter module is shown in Fig.9.

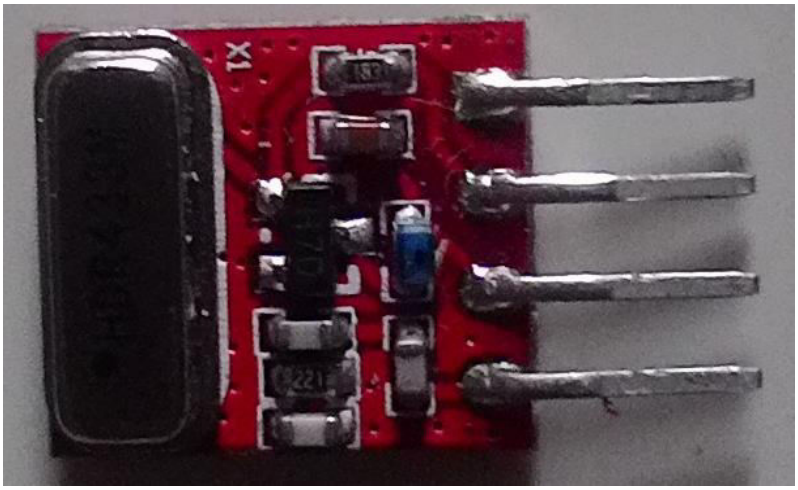

Fig.9. RF Transmitter module

g) *RF Receiver*

In this proposed system we are using RF Receiver module for receiving transmitted data from RF transmitter through air [5]. This module consists of 8 pins namely VCC, GND, DATA and ANT. This receiver is also operates at 433.9MHz and has sensitivity of 3uV. This module is operates at 1.5V-5.5V DC and has both linear and digital outputs. Output from RF Receiver module is given to Decoder. RF Receiver module is shown in Fig. 10.

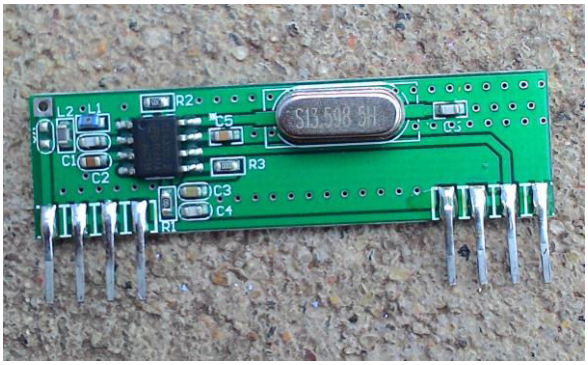

Fig.10.RF Receiver module

h) Relay Driver

Rely driver consists of NPN transistor, diode, resistor and relay. In this Paper we are using two electromagnetic relay for switching the electrical appliances [6], [7] & [8]. This relay driver is used to drive 230V /5A load. It consists of 5 pins namely NC (Normally closed), NO (Normally Open), C (Common) and two coil leads. When the transistor gets high input signal from decoder, transistor is switching the relay contacts from NC to NO. The loads are connected to NO terminal of relay. So loads are turned on condition based on the GUI screen clicked. When the load off button is clicked in GUI screen, then input of transistor is low signal. Now the loads are turned off condition. PN junction diode 1N4007 is connected parallel to relay coil. Because this diode is used to avoid circuit damage from back electro motive forces (emf). Relay driver is shown in Fig.11.

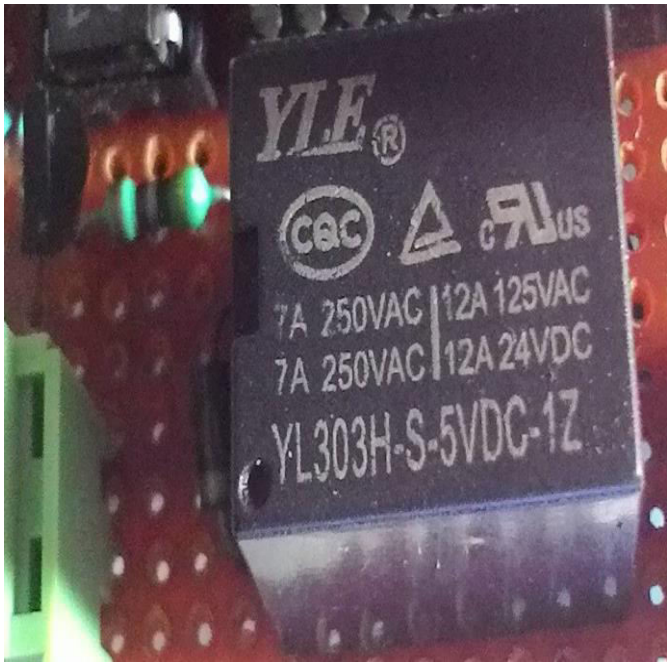

Fig.11.Relay Driver

The following diagram shows the proposed system hardware model. Transmitter unit is shown in Fig.12. Receiver unit is shown in Fig.13.

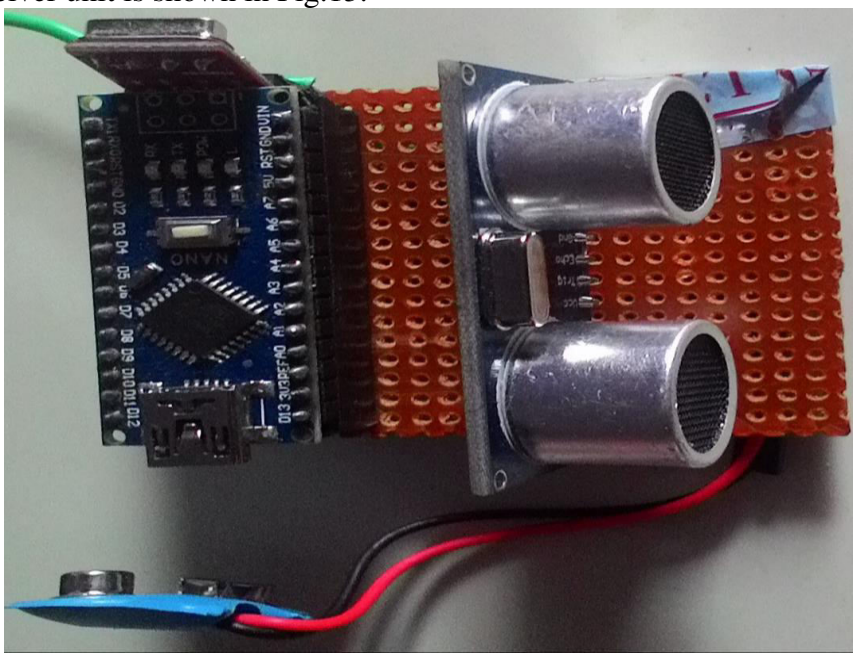

Fig.12.Transmitter Unit

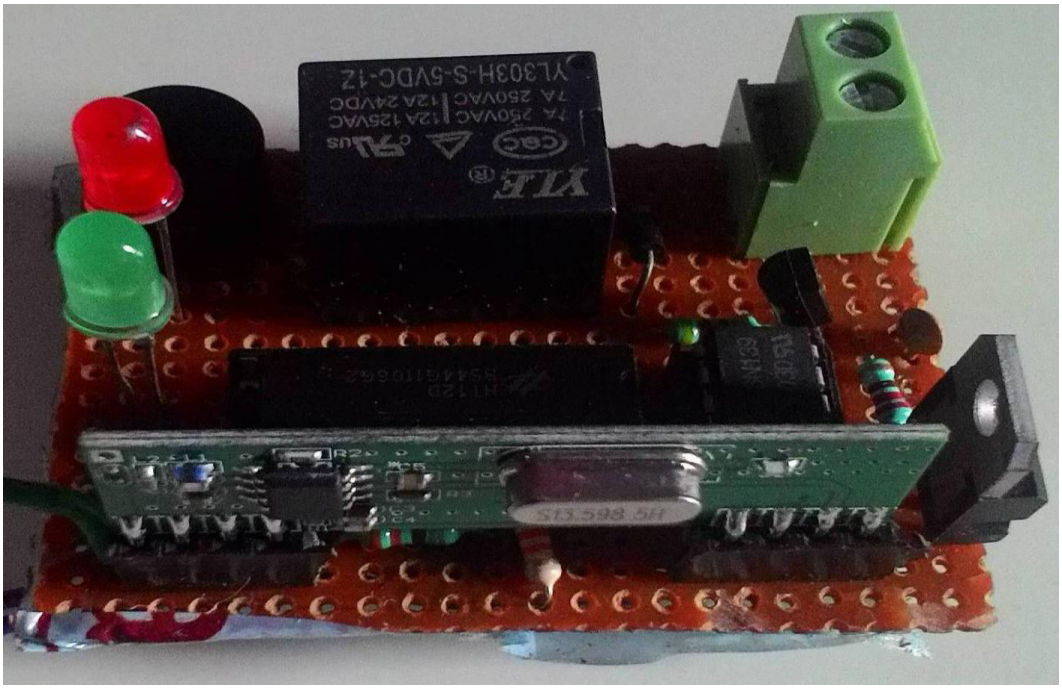

Fig.13.Receiver Unit

IV. CONCLUSION & FUTURE WORK

This article proposes a reliable and user friendly Smart water saver using ping sensor and RF communication. In this proposed system water over flow is prevented with help of ping sensor and also prevents the motor from dry running. One more advantage of this system is does not allows the water tank in empty condition. Because the motor is automatically switch on when the water is below the low level. In RF communication system wires are no need to connect transmitter to receiver. Because data's are transmitted through air around 300 meters. Users are no need to worry about the water tank condition when they are leaving the home for one or two days. Because this proposed system is monitor and control the water tank automatically. This proposed method can be used in industries, schools, hospitals, houses and apartments. In future the proposed idea can be extended to monitor the water tank through internet from anywhere in the world.

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