IoT Based Bore Well Monitoring System

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Abstract— This paper brings in continuous monitoring of bore well in the agricultural land and this is "IoT based bore well monitoring system". To solve this we are to introduce a continuous process through IOT using micro controller. This is programmed to read the data from sensors and performs various calculations. It will operate in an automated process where the job of the farmer is only to monitor the parameters like water available, quantity of water taken out and leakage in the pipeline etc. In a very short span of time, the overall statistics inside the bore well will be gathered with minimal man power. This provides simple monitoring and the time spent by the farmer in worrying about water scarcity is being reduced.

Keywords: Automatic Monitoring, Quick Analysis, Bore Well and Arduino

I. INTRODUCTION

India is an agrarian country where the farmers are predominantly dependent on groundwater. But an irregular distribution of rainfall and the failure of monsoon are the major contributors of the decreased ground water level. Thus, the farmers are forced to drill bore wells to greater depths and depend on it. Majority of people living in urban areas are also dependent on bore wells these days as there is no other major alternative for water source[2][3][5][6]. The over-usage thus causes problems such as over-exploitation of groundwater depletion of water tables, saltwater encroachment, drying of aquifers, groundwater pollution, and soil water logging and salination level has increased[2][3].

Thus, to solve this we introduce "IoT based bore well monitoring system". Farmers will have no clue about what is happening inside the bore well. This is the importance relying in monitoring those parameters which in turn makes the farmer to observe and take the necessary action.

II. PROBLEM STATEMENT

A bore well is created using drilling vehicle to get the water from ground resources. The water from the well is taken out using motor pump[1]. Bore wells are vertically drilled from the earth surface towards underground, to extract the water. Electrical motor pumps are usually used to pump the water from the bore wells. These pumps may work efficiently but decreases the groundwater level at an increased pace. Water level inside the bore wells is difficult to determine as it runs around 500ft below from the earth surface[2][3][5][6].

Traditional methods used in measuring water level includes scale and chalk which provides inaccurate readings[5][6]. Major problem is that the person has to be near the bore well site in order to measure water level, PH value and contamination which is highly time consuming and quite difficult method.

III. SURVEY

Small survey was done in nearly fiftty agricultural lands in and around our city. When we went on examining every bore well, we found individual farmer standing with thought full of uncertainty about water resource available inside the bore well. This analysis helped us to come out with designing a single monitoring system for doing the entire measurements in a continuous process.

IV. METHODOLOGY

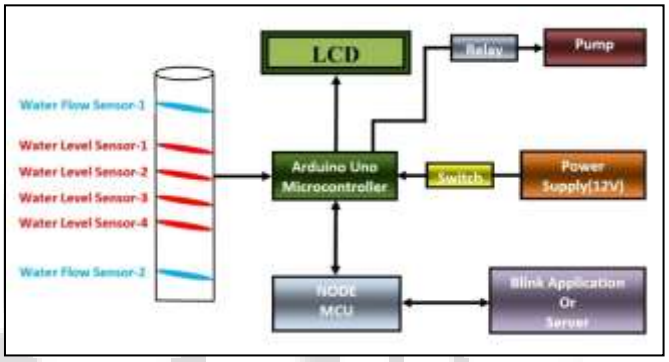

Fig. 1: Block Diagram

The block diagram shows the overall working of the system. The required program for Arduino Uno and NodeMCU are created through software and are fed to the micro controllers using usb cable. Then the Arduino Uno and the sensors are connected, with this the process is made continuous. LCD display is to view the parameters acquired from the sensors. They are being interfaced with IOT using NodeMCU to mobile phones through Blynk server Application where the current status of water level and several other parameters can be viewed and thereby farmer can take further action.

V. HARDWARE COMPONENTS

In our project, IoT Based Bore Well Monitoring System, we have developed a setup for continuous process with IoT enabled solution. The following are the hardware components used,

1) Arduino Uno
2) NodeMCU
3) LCD display
4) Water Level Sensor
5) Water Flow Sensor
6) Relay
7) Dc Motor Pump
8) Power Supply
9) Switch

A. Arduino UNO:

Arduino UNO is a micro controller which consists of 6 analog pins and 14 pins(fig 3) which can either be digital input or digital output as shown in Figure 2. This arduino operates with 5V. Arduino helps in communicating with a computer, another arduino board or another micro controller. The pins Tx and Rx is meant for transmitting and receiving data of requirement which makes these 2 pins for lead role of serial communication.

Fig. 2: Arduino Uno Micro Controller

Arduino is an open-source electronics platform used for hardware and software interface. Arduino Uno board is able to read inputs – water level from a water level sensor, a flow of water from water flow sensor, or a message and turn it into an output – turning on a motor, turning on an LED indicator, displaying it in LCD along with IoT interface. To do so the Arduino programming language and the Arduino Software (IDE) are used in computer.

1) Configuration:

- Micro controller ATmega328
- Operating Voltage 5V
- Input Voltage 7-12V
- Digital I/O Pins 14
- Analog Input Pins 6
- Flash Memory 32 KB
- Clock Speed 16 MHZ

2) Pin Diagram:

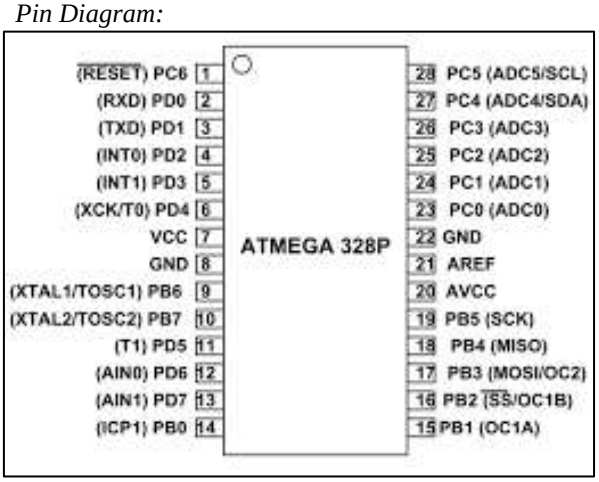

Fig. 3: Arduino Uno Micro Controller Pin Diagram

3) Arduino IDE:

The Integrated Development Environment (IDE fig 4) is a combination of editor, linker and a compiler which helps the developer to make their coding for their Projects. Arduino IDE plays a major role in the open source platform for prototyping and easy to access of library functions. It is a user friendly tool for beginners and it supports many programming languages like embedded C, Luna etc.

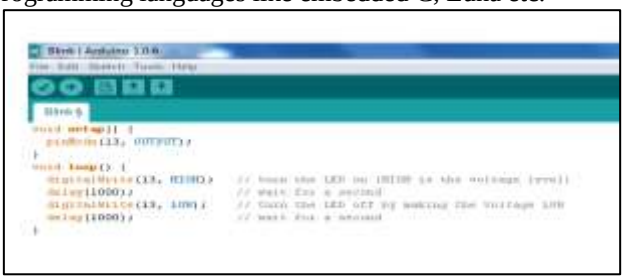

Fig. 4: Arduino Uno IDE 1.0.6

B. NODE MCU:

NodeMCU is an open-source IoT development kit that helps in designing a product especially using IoT with similar kind of codings as that of Arduino Uno.

This module is similar to ESP8266 module which is a low-cost Wi-Fi module. But NodeMCU chip is incorporating both a full TCP/IP stack and micro controller capability as shown in fig 5.

It is introduced by Espressif Systems. The ESP8266 NodeMcu is a complex device, which combines some features of the ordinary Arduino board with the possibility of connecting to the internet through Wifi connectivity.

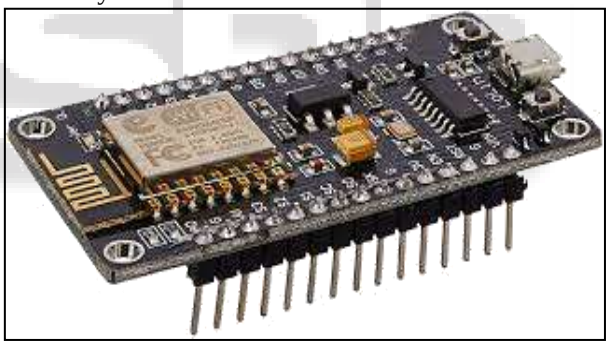

Fig. 5: NodeMCU Micro Controller

NodeMCU can be programmed using Arduino software platform itself. Suitable configurations should be done in Rrduino IDE before started coding for NodeMcu.

Board specifications should be chosen correctly for error free dumping and code compilation as shown in fig 5.1.

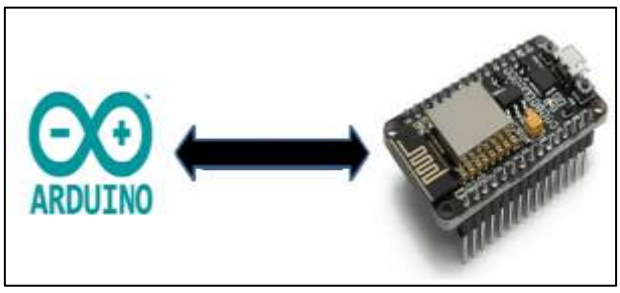

Fig. 5.1: NodeMCU Micro Controller with Arduino

1) Smartphone with Blynk Application:

Blynk is an Android application to control Arduino Uno over the Internet.It's a platform where we can build a graphic interface over internet for our project. It is made

simple by dragging and dropping the visual widgets as shown in fig 6.

Blynk is not only specific to Arduino Unoboar . Instead, it is supporting many hardwares of our choice. Our Arduino Uno is linked to the Internet over Wi-Fi embedded in this new ESP8266 chip. Blynk app will get your Uno board online.

Fig. 6: Blynk Application in SmartPhone

C. LCD Display:

16*2 LCD displays are mostly used as reliable output device. For any of the micro controller based project, it is not possible to use debugger every time. So 16*2 LCD display can be used to test the output as shown in fig 7.

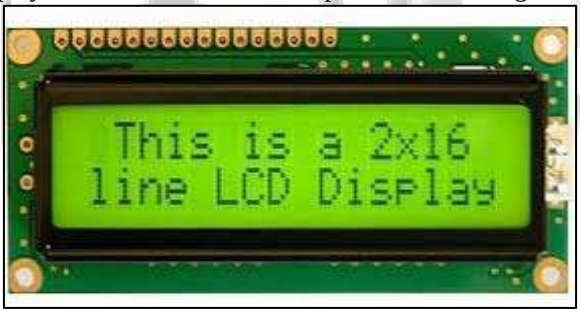

Fig. 7: 16*4 LCD Display Module

LCD display will accept two types of signals from Arduino Uno such as data and control signal. These two signals are given to LCD module through its RS pin.

LCD display will take a time of 39-43µS to execute the given command. It is exceptional for clearing the previous display and to seek cursor to initial position it will take 1.53ms to 1.64ms.

D. Water Level Sensor:

Water level sensors are used to find the level of water inside the bore well. Contact type sensor is used for detecting the level of water. Contact type water level sensor used is shown in fig 8.

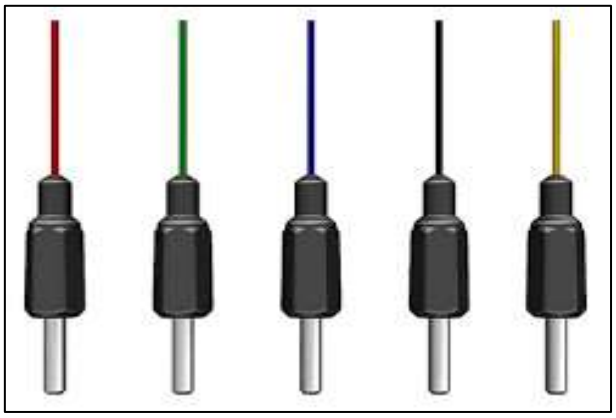

Fig. 8: Water Level Sensor

This sensor is a corrosion free material and it comes with 2m cable wire for easy installation. Specifications of this sensor is as follows:

- Max Switch Current : 5A (DC)
- Max Switch Watt : 10W / VA
- Ideal Operating Ratings : Voltage: 2 to 12V DC
- Current: 5 to 50ma DC

E. Flow Sensor:

Flow sensor is used inorder to measure the flow of water from the bore well. Water flow is used to calculate the quantity of water fetched from the bore well using motor.
It is also used to find any leakage in the pipeline inside the bore well. Pressure of the motor can also be calculated with this sensor value.

Fig. 9: Water Flow Sensor

This sensor is made of a plastic, a rotor and a sensor. The rotor rotates when water / liquid flows through the pipe and its speed will be directly proportional to the flow rate. The Hall Effect sensor will provide a pulse with every revolution of the rotor.

F. Relay:

A relay is an electromagnetic switch operated by a minor electric current. Many sensors are incredibly sensitive pieces of electronic equipment and produce only small electric current [2][3][5][6]. But frequently we need them to drive bigger parts of machine that use bigger currents.

Relays channel the gap, making it probable for small currents to trigger larger ones. It means relays can toil both as switches (turning on and off) and amplifiers.

The relay used in this project is to work automatically, and hence this does not require manual

intervention during mal functioning. The basic relay used would be as shown below fig 10.

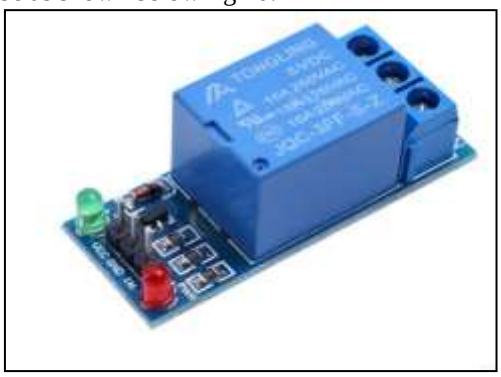

Fig. 10: Single Channel Relay

We used single channel relay of 5V coil for controlling the overall operation. Motor is controlled using theis relay and is connected to the Arduino Uno. The input is given from arduino Uno and thr output pin is connected to motor.

G. DC Water Pump:

DC powered water submersible pump will operate in direct current to move water in a variety of ways. This pump will operates in 12 volts of DC power.

Fig. 11: Miniature Circuit Breaker

The DC motor is sealed in a plastic case attached to the impeller as shown in fig 11. It is powered through a simple gear mechanism. The rotor continues to spin, driving the impeller and powering the pump and there by pumping out the water.

H. Power Supply:

This project will require the operating voltage of 12V DC. It is powered with 12V DC adapter circuit. Adapter circuit comes with transformer and voltage regulators to provide constant DC output of 12V. It is sealed inside insulated material with external cable length of 2m as shown in fig 12.

Fig. 12: Power Supply

This adapter comes with the following specifications,

- Input Type: AC
- Input: 100-240 V AC 50/60 Hz
- Output Type: DC
- Output: 12 Volts, 1 Amp

I. Switch:

Switch is used to break the circuit between power supply and the components used. In this project Auto/Manual mode switch is used inorder to operate the system in either automated mode or manual mode.

Fig. 13: Auto/Manual Switch

The switch will break the circuit when it isin neutral position asshown in fig 13. Further operation ofthe switch is similar to normal switches. This switch comes with the following specifications,

Current rating: 10A -125 VAC, 6A -250 VAC
Housing dimension: 18.4 mm L x 12.9 mm W x 13.8 mm D
Contact: 1

VI. Design and Implementation

The circuit setup along with the function of the process are shown in the below figures,

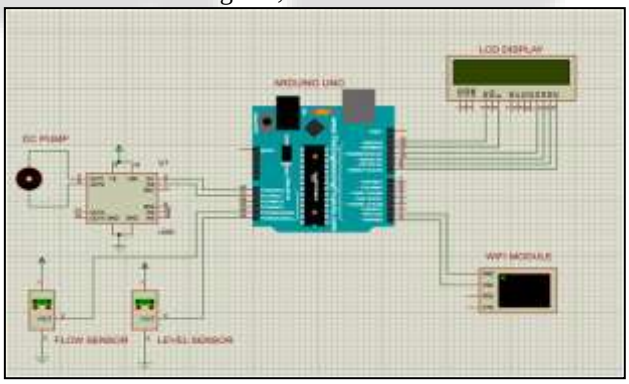

Fig. 14: Simulated circuit diagram

Fig. 15: Coding for Arduino Uno using arduino IDE software

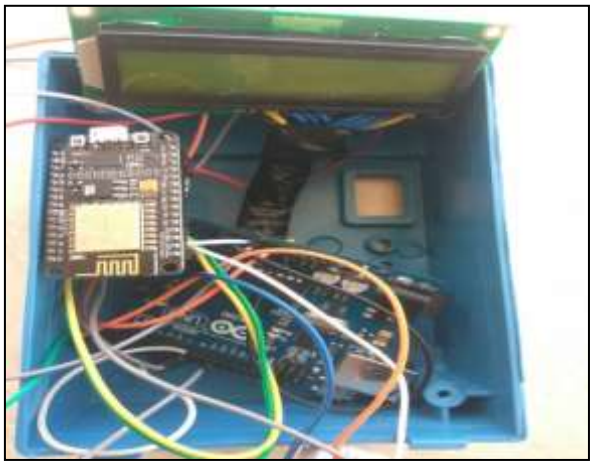

Fig 16: Hardware set up in the panel board

Fig 17: Hardware set upin the bore well

Fig 18: Lcd display in the Pannel board

Fig 16: Blynk Application image in Mobile Phone

VII. CONCLUSION

The following results are been achieved through this work,

1) Water availability, water leakage in pipelines and quantity of water fetched from inside the deep bore well are calculated with maximum accuracy.
2) This helps a farmer to predict the water resource available for his farming purposes.
3) This automation technology has overcame the previous methods and also reduced the man power.

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