

# Boiler Overflow ALET System using IoT in Paper Industry

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**Abstract:-** Boilers have many applications from residential and commercial heating to power generation. Better control of boilers reduces environmental pollution. The over flow of boiler or drying of boiler is an important problem in paper industry that subject to sudden load disturbances, which are common in current market driven electricity industry. Experimental results are presented to support the performance of the control mechanism. The feedwater flow in a boiler is manually operated till now. In this project, the drum level of a boiler is monitored and controlled by using internet of things.

## 1. INTRODUCTION

Boiler is nothing but a design designed for heating. It is called boiler because heating was done with the coal, steam or chemical liquors and the steam comes as an output.

With the help of furnaces the air is heated and distributed through pipes for domestic purposes and industries as well. Boilers heat the water, and provide either hot water or steam for heating. Water is heated and it turns into steam and it spins the turbine which drives an electrical generator. After passing through the turbine, the condenser condenses the steam. It is one of the ways of electricity generation.

If the level becomes too high, water can be carried over into the steam pipe work, possibly damaging downstream equipment. If the level becomes too low, then the pipe gets heated unnecessarily and the energy is wasted also the pipes get damaged. The boiler drum level control strategy is designed as single element control, two element control or three element control. If there is any mismatch between inflow and outflow will cause a continuous difference in the drum level. The distributive control system or SCADA are existed to eliminate the problem. As the internet of things is widely used in recent days and also it makes monitoring and controlling simpler and less expensive. With the help of sensors to detect the drum level the water pump is opened and closed. The level of the boiler is displayed on the webpage.

**Keywords:-** *Three element control, Boiler drum level, Feed water flow, Steam Flow, Arduino microcontroller and IOT.*

## 2. OBJECTIVE

- ✓ Boiler steam output and feed water input should be balanced properly.
- ✓ Boiler drum level should be maintained

- ✓ Automatic water inlet with respect to the sensors added.

## 3. SYSTEM ANALYSIS

### 3.1 EXISTING SYSTEM

Three element control, it assures that the signals versus feedwater flow will have a constant relationship by replacing the open flow characteristics of the feedwater control valve with a closed loop feedback control of feed water flow. With the help of distributive control system, SCADA or PLC, the level of drum level is controlled. The alarm goes on for every fixed minutes and the controller off the feedflow to the boiler or it can automated through trip method.

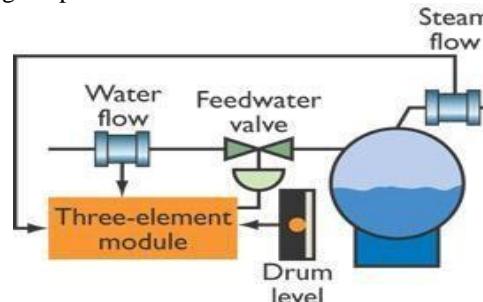


Fig 1.Three element control of boiler drum

#### 3.1.1 DRAWBACKS

- 1. Long connections are needed so we have to use more wires.
- 2. More spaces are needed for fitting wire communications.
- 3. Monitoring action has possible only in control unit and man power needed.
- 4. In the processing unit we need to measure three parameters.
- 5. The methodology is complicated comparatively

### 3.2 PROPOSED SYSTEM

In our proposed system, it deals with the boiler drum level controlling. The boiler level is controlled by arduino from the output of sensors. Arduino receives signals from the sensors and sends to the LCD display. Another side with the help of relay driver, the inlet valve is opened and closed automatically with respect to the signals received. All these informations are automatically send to the manager and assistants with the help of Web Server.

### 3.2.1 MERITS

1. In this concept the major advantage is boiler drum level controlling, this action is taken by the Internet of Things (IOT), which means the signal from Internet of Things (IOT) connected devices like smart phones or laptops etc., 2. From the devices the signal will be sent to the arduino for controlling the feedwater flow inside the boiler drum by relay action.

3. In this system the monitoring action can also done with the help of website address.

4. Using Internet of Things (IOT) instead of other communication control system we can achieve higher speed of control with less space of RAM and low power consumption.

### 4. BLOCK DIAGRAM

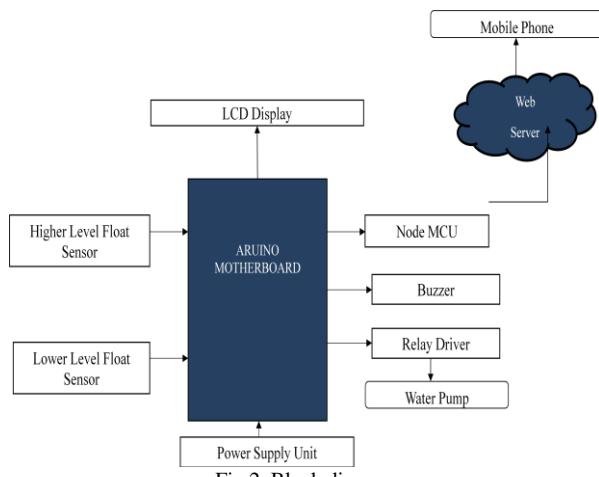


Fig 2. Block diagram

### 5. ELEMENTS USED

#### 5.1 HARDWARE REQUIREMENTS

1. Arduino board
2. Float sensor
3. Buzzer
4. Node MCU
5. Relay
6. Water pump motor
7. Power supply
8. Liquid crystal display

#### 5.1.1 ARDUINO BOARD

Arduino is an open source platform based on easy hardware and software. Arduino boards reads inputs-light on a sensor, a finger on a button, or a twitter message and turn it into an output that activates a motor, turning on an LED. The arduino UNO board is a microcontroller ATmega328. It has 14 input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button.

### 5.1.2 FLOAT SENSOR

A float switch/sensor is a type of water level sensor, it is used to detect the level of liquid within a tank. The float switch may be used to control a pump, as an indicator, an alarm, or to control any other devices. In a float switch, the magnetic reed switch is hermetically sealed in a stem, most often made from plastic or stainless steel. The float encases a sealed magnet, which moves up and down the length of the stem as a fluid level rises and falls. As the magnet passes by the contacts in the encased reed switch, they touch and complete a circuit between the two lead wires. To complete a circuit, float switches utilize a magnetic reed switch, which consists of two contacts sealed in a glass tube. When a magnet comes close to the two contacts, they become attracted to each other and touch, allowing current to pass through. When the magnet moves away, the contacts demagnetize and separate (breaking the circuit).

### 5.1.3 BUZZER

Buzzer is based on the inverse principle of piezo electricity, It is based on the phenomena of generating electricity when mechanical pressure is applied to materials and the vice versa is also true. Such materials are called piezo electric materials. Piezo electric materials are either naturally available and also manmade. Piezo ceramic is a manmade material, which poses piezo electric effect and is widely used to make the heart of piezo buzzer. When it is subjected to an alternating electric field they compress, in accordance with the frequency of the signal there by producing sound.

### 5.1.4 NODE MCU

Node MCU is an open source firmware and development kit that helps you to prototype or build IOT product. It includes firmware which runs on the ESP8266 Wi-Fi soc from espressif systems and hardware which is based on the ESP12 module. The firmware uses the lua scripting language.

### 5.1.5 RELAY

A relay is an electromagnetic switch operate by a relatively small electric current that can be able to turn on or off a much larger electric current.

### 5.1.6 WATER PUMP MOTOR

A pump is a device that moves the fluids such as liquids or gases, or sometimes slurries, by mechanical. Reciprocating hand pumps were widely used to pump water from water tanks and wells. It converts the mechanical energy of motor into the potential energy of flow that comes by means of multiple whirls, which are excited by the impeller.

### 5.1.7 POWER SUPPLY

Power supply is a source of electrical power. A system that supplies electrical power or other types of energy to an output load is called a power supply unit. This term is most commonly applied to electrical power supplies, less often to mechanical ones, and rarely to others.

### 5.1.8 LIQUID CRYSTAL DISPLAY

An LCD is an electronic display module which uses liquid crystal to display a visible image. The 16x2 translates a display 16 characters per line in 2 such lines. In this LCD each character is displayed in an 5x7 pixel matrix.

### 5.2 SOFTWARE REQUIREMENTS

1. Arduino IDE
2. Proteus 8

#### 5.2.1 ARDUINO IDE

Arduino is an open-source platform based on an easy-to-use hardware and software. It consists of a circuit board, which can be able to program (referred to as a microcontroller) and a ready made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the coding to the physical board. Arduino boards are able to read analog or digital input signals from the different sensors and turns it into an output such as activating a motor, turning LED on or off, connect to the cloud and many other actions. Unlike most previous programmable circuit boards, Arduino does not need any extra piece of hardware (called a programmer) in order to load a new code onto the board. We can simply use a USB cable.

#### 5.2.2 PROTEUS 8

Proteus is a simulation software tool developed by Labcenter Electronics for Electrical and Electronic circuit design. It also possess 2D CAD drawing feature. It deserves to bear the tagline “From concept to completion”.

### 6. INTERNET OF THINGS

The Internet of things (IOT) is the network of physical devices, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables the objects to connect and exchange.

### 7. WORKING

To identify the level of the boiler two float sensors are used. One of the float sensors are kept at the lower level of the boiler. When the water level inside the boiler reaches its lower point, the ring like structure goes down indicating the low level. The lower level float sensor sends signal to the arduino board. The arduino sends command to open the water pump with the help of a relay driver. At the same time, it activates the buzzer and using the node MCU it connects the mobile phone with the web server where the message will be sent. So, that the manager or any desired person can monitor it. When the boiler level increases and reaches the higher level float sensor, the ring like structure of the sensor touches its roof point. Thereby, the arduino receives the boiler higher level signals from the sensor and using the relay driver, the water pump is closed. At the other side, the arduino activates the buzzer. With the help of node MCU, the message of the boiler's higher level will be sent to the web server that can be seen via mobile phones. The current will be sent to the step down

transformer where the ac supply will be converted to dc supply. Then it will be sent to the power unit from where the arduino receives power.

### 8. SIGNIFICANCE

#### 8.1 THREE-ELEMENTS BOILER DRUM LEVEL CONTROL

- ✓ Conversion of water into steam is the primary function of a utility boiler.
- ✓ The steam pressure is used to turn a steam turbine thus, generating electricity.
- ✓ Within the boiler drum there exists a steam/water interface.
- ✓ Boiler steam drum water level is one of the important parameters of power plant that must be measured and controlled.

#### 8.2 REAL TIME MONITORING AND CONTROLLING OF BOILER DRUM

- ✓ The boiler drum level control unit is one of the main parameter in the thermal power station.
- ✓ Currently the boiler drum parameters are monitored only by using MATLAB software.
- ✓ There is no automatic control available.

#### 8.3 BOILER DRUM LEVEL CONTROL USING DCS ONE/THREE ELEMENT

- ✓ The scope of this control system is to maintain the boiler drum level to the normal water level at all loads.
- ✓ Boiler drum level control is critical for both thermal plant protection and equipment safety and applies equally to both high and low levels of water within the boiler drum.

### 9. CONCLUSION

In this paper, monitoring and control over flow system is proposed. The feedwater flow can be controlled in a better way by using IOT. By using IOT, instead of other communication control system it has been easier to achieve higher speed of control with low power consumption. If it is needed, we can also include additional three elements in the boiler drum. The three parameters such as temperature, pressure and humidity of feed water in the boiler drum can be controlled using this current IOT technology. It is easier to monitor and control most of the parameters in boiler drum.

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