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TEMPERATURE CONTROLLING OF WATER FOR DOMESTIC AND INDUSTRIAL APPLICATIONS

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Abstract *: In Now days we domestic uses of hot water include cooking, cleaning, bathing, and space heating. In industry, hot water and water heated to steam have many uses. There is need to develop wireless sensor network for temperature controlling of water for save fuel and for to save electricity. In this Paper, we present wireless sensor network for Temperature controlling of water. Which can Control the temperature, this can use for number of applications Temperature controllers are used in a wide variety of industries to manage manufacturing processes or operations. Some common uses for temperature controllers in industry include plastic extrusion and injection molding machines, thermo-forming machines, packaging machines, food processing, food storage, and blood banks, control the temperature of water , control the temperature of industrial machines, in the industry where temperature Controlling of water is necessary.*

Keywords*: IEEE 802.15.4, Temperature Controlling, WSN, Zigbee, TCN75, PIC Microcontroller*

I. INTRODUCTION

Some Applications of Temperature controlling

Heat Treat/Oven

Temperature controllers are used in ovens and in heat-treating applications within furnaces, ceramic kilns, boilers, and heat exchangers.

Packaging

In the packaging world, machinery equipped with seal bars, glue applicators, hot melt functions, shrink wrap tunnels or label applicators must operate at designated temperatures and process time lengths. Temperature controllers precisely regulate these operations to ensure a high quality product output.

Plastics

Temperature control in the plastics industry is common on portable chillers, hoppers and dryers and molding and extruding equipment. In extruding equipment, temperature controllers are used to precisely monitor and control temperatures at different critical points in the production of plastic.

Healthcare

Temperature controllers are used in the healthcare industry to increase the accuracy of temperature control. Common equipment using temperature controllers includes laboratory and test equipment, autoclaves, incubators, refrigeration equipment, and crystallization growing chambers and test chambers where specimens must be kept or tests must be run within specific temperature parameters.

Food & Beverage

Common food processing applications involving temperature controllers include brewing, blending, sterilization, and cooking and baking ovens. Controllers regulate temperature and/or process time to ensure optimum performance.

The functions of temperature controls to medical or pharmaceutical companies are to ensure the effectiveness and safety of drugs. Some medicines are temperature sensitive that is why laboratories have to monitor the temperature of their storage and testing drugs. Also, the quality of shipped pharmaceutical products is a concern. Precise temperature in vessels is needed when shipping medicines. However, the variations in climate zones among countries indicate that there are different standards in maintaining of drugs. Temperature controls have to be set according to the standard of the place where the medicine is. Temperature control is essential in food industries as well. Food processes include cooking, storing, freezing and other more applications. These practices require setting proper hotness and coldness of goods as a way of maintaining their quality and safety. The monitoring of hot perishable goods differs from the cold ones. Goods that are purchased cold must be kept inside a freezer immediately. Do not put newly cooked food in the refrigerator right away. Let it cool first for less than two to four hours. For leftovers, they must be refrigerated at once to avoid growth of harmful bacteria.

Our health highly depends on the food and drugs we take. Eating contaminated food can cause illness which would require us to take medicines. However, the medicine we are going to consume might be ineffective if not

stored properly and might even result for our condition to get worse. This scenario clearly explains that temperature controls are vital for human wellness and prevention of diseases.

A. Wireless Sensor Networks:-

It is equally distributed autonomous devices using sensor which has capable of controlling temperature of wireless sensor nodes.

Actually what is a wireless sensor network? It is nothing but equally distributed autonomous devices which has capable of monitoring physical as well as environmental conditions .Each autonomous device known as sensor node Each sensor node consist of TCN 75, pic 16f877, Zigbee 802.15.4. Sensor network can inform different environmental condition such as temperature, sound, vibration, pressure, motion, and pollutant at various different locations especially for building in campus area.

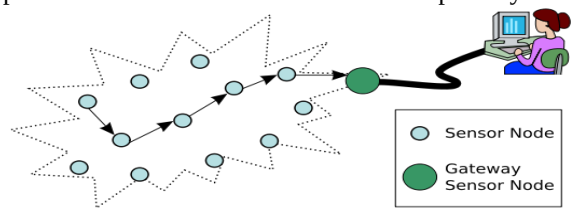

Fig.1 Wireless sensor network Architecture

Fig.1 shows wireless sensor network which consist of equally distributed autonomous devices. Each device has TCN 75 temperature sensor, PIC 16F877, Zigbee 802.15.4.When sensor node detect emergency then that sensor node will inform about emergency to Master node. We have to control the temperature of sensor node. Here sensor node consists of TCN 75, PIC 16f877, Zigbee 802.15.4, and LCD. Next, we will discuss role of the each component in detail.

Implementation steps

1) Sensor node will contain TCN75, PIC16f877, Zigbee series 1 model For Tx/Rx
2) Master node will contain the zigbee series 1 model and PC.
3) Locate the sensor node at different locations in building.
4) When emergency detected by any sensor node, it will inform to master node.
5) Master node will show temperature on PC.
6) Wireless sensor nodes will provide temperature monitoring.
7) This project will focus on fire emergency and temperature monitoring and controlling.

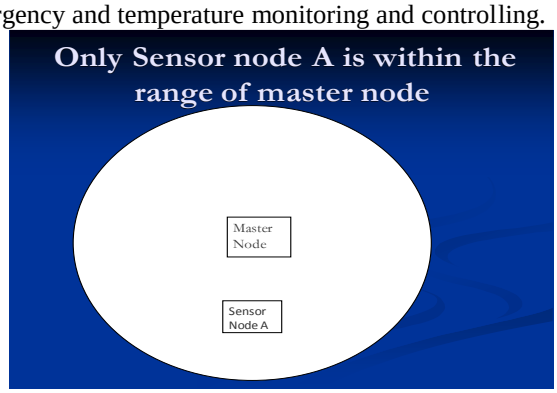

Fig.2 Wireless sensor network

As shown in fig. 2 we are going to develop sensor network which consist of master node/monitoring node and sensor node. As previous discussion sensor node consist of TCN 75, PIC 16f877, and Zigbee 802.15.4 standard. Master node/Monitoring node consists of Zigbee 802.15.4, Max 232, DB-9 Connector and laptop. But how the communication take place from master node to sensor node first up all master node will send the request in the form of frames <RAM> when sensor node receive it then sensor node will send temperature available at sensor node A will send <DMA025> when master node decode it and display the temperature on master node/monitoring node.

Frame structure :-<RAM>-Read data from sensor node A to M
<-Start of frame
R-Read
A-Sensor node A
M-Master node A

>-End of frame
<DMA025>-Data from Sensor node A to M.
<-Start of the frame
D-Data
M-Master node
A-Sensor Node A
025-Temperature available at sensor node A
>-End of frame

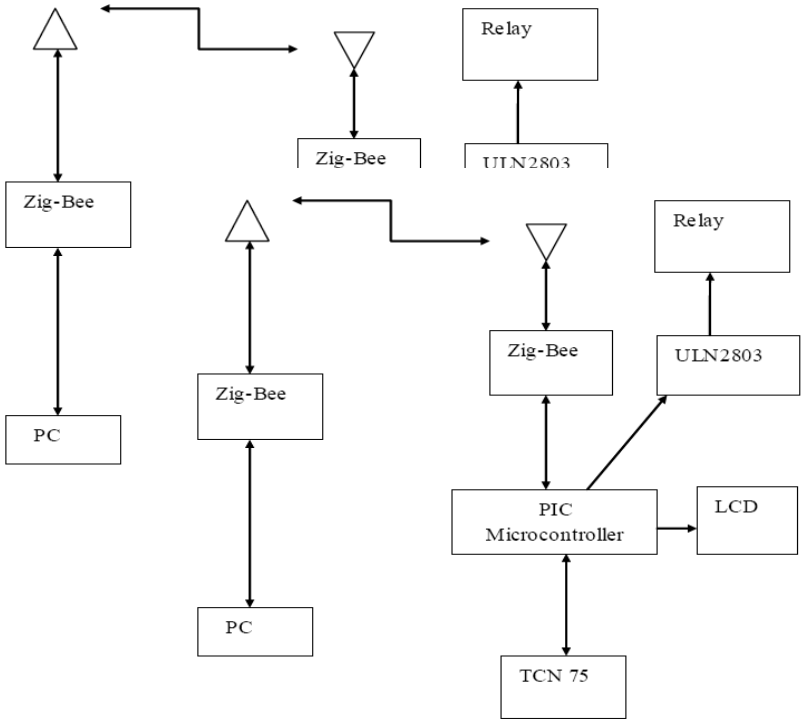

Fig.3 Sensor network for temperature controlling

As shown in figure 3 we can design circuit for sensor network for temperature controlling. It consist of Master node/Monitoring node ,Sensor node .Sensor node consist of TCN 75,PIC 16f877,Zigbee 802.15.4 ,LCD, driver circuit ULN 2803 and relay. We have discussed in the architecture of TCN 75 It consist of Tset, Thyst registers. We have to write the Tset value into Tset register if input temperature increases above set point temperature it generate interrupt activate relay and in this way we can use as relay as simple on off controller. In the application we can use temperature controlling of water or temperature controlling of industrial machines. As shown in above diagram we can develop a sensor network for temperature controlling of water for industrial and domestic applications. Also it is possible to increase the sensor nodes for communicating over longer distance and to monitor temperature from more than one node.

II. FEEDBACK TEMPERATURE CONTROL LOOP

Regulation through feedback control is achieved by acting on the change in the controlled variable that was induced by change in load. Deviation in the controlled variable are converted into changes in the manipulated variable and sent back to the process to restore the balance. The basic concept indicates the backward flow of information from the output of the process back to its manipulated input. The load can be divided into various components such as feed rate, feed composition, and temperatures. These may be balanced by a single manipulated variable. Feedback, by its nature, is incapable of correcting a deviation in controlled variable at the time of detection. In any process, a finite delay exists between a changing of the manipulated

variable and the effect of the change on the controlled variable. Where this delay is substantial and the process is subject to many frequent disturbances, considerable difficulty can be encountered in maintaining the control. Perfect control is not even theoretically obtainable, because a deviation in the controlled variable must

appear before any corrective action can begin. In addition, the value of the manipulated variable needed to balance the load must be sought by trial and error, with the feedback controller observing the effect of its output on the controlled variable. The effectiveness of the feedback control depends on the dynamic gain of the controller in relation to the frequency and magnitude of the disturbances encountered.

III. SHELL AND TUBE HEAT EXCHANGER

A shell and tube heat exchanger is a class of heat exchanger designs. It is the most common type of heat exchanger in oil refineries and the other large chemical processes, and is suited for higher-pressure applications. As its name implies this type of heat exchanger consists of shell (a large pressure vessel) either a bundle of tubes inside it. One fluid runs through the tubes and another fluid flows over the tubes through the shell(a large pressure vessel) with a bundle of tubes inside it. One fluid runs through the tubes is called a tube bundle and may be composed by several types: plain, longitudinally finned etc.

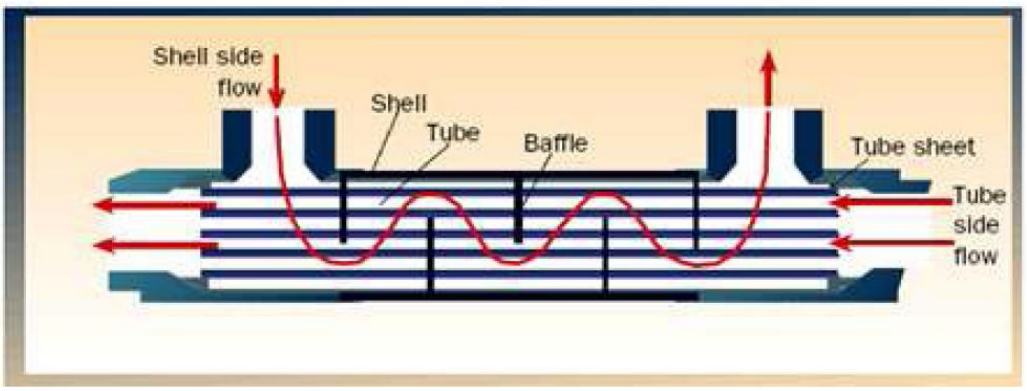

Fig.4 Heat Exchanger

Two fluids, of different starting temperatures, flow through the heat exchanger. One flows through the tubes (the tube side) and the other flows outside the tubes but inside the shell (the shell side). Heat is transferred from one fluid to the other through the tube walls, either from tube side to shell side or vice versa. The fluids can be either liquids or gases on either the shell or the tube side. In order to transfer heat efficiently, a large heat transfer area should be used, leading to the use of many tubes. In this way, waste heat can be put to use. This is an efficient way to conserve energy. Heat exchangers with only one phase (liquid or gas) on each side can be called one-phase or single-phase heat exchangers. Two-phase heat exchangers can be used to heat a liquid to boil it into a gas (vapor), sometimes called boilers, or cool a vapor to condense it into a liquid (called condensers), with the phase change usually occurring on the shell side. Boilers in steam engine locomotives are typically large, usually cylindrically-shaped shell-and-tube heat exchangers. In large power plants with steam-driven turbines, shell-and-tube surface condensers are used to condense the exhaust steam exiting the turbine into condensate water which is recycled back to be turned into steam in the steam generator. Temperature control of the process can be affected using electric, pneumatic, electro-pneumatic and self-acting controls. This Module details some common applications including process vessels, heat exchangers and high temperature fail safe control.

Applications

Applications of pilot operated, self-acting temperature control injecting steam into a tank are Jacketed pans., Tracer lines., Tanks., Acid baths., Hot water storage calorifiers., Heater batteries., Unit heaters.

Applications of Pneumatic temperature control which need accurate and consistent temperature control, with variable and high flowrates, and/or variable upstream pressure, which require intrinsic safety.

Applications of Electro pneumatic temperature control are Which need accurate and consistent temperature control , With variable and high flowrates, and/or variable upstream pressure.

Applications of Electro pneumatic temperature control are Space heating of large volumes. For example; warehouses, workshops, aircraft hangars.

Applications of High temperature fail safe control are Domestic hot water services (DHWS) supplying general purpose hot water to users such as hospitals, prisons and schools.

IV. CONCLUSION

As discussed earlier we can able to design sensor network for temperature controlling of water for industrial and domestic applications.

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