

# Zigbee Based Power Control System for Industrial Automation

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**ABSTRACT:** Nowadays, a lot of researchers are working on the development of various production parameters to maintain good finished product so that customer can enjoy his product with satisfaction. The researchers also try to achieve lower power consumption for such process, as it works on DC they also try to work this on AC and has a longer life-time compared to the SCADA System. In this project, controlling of various production parameters are further try to investigate as it is necessity to also control such parameters in future. A high-speed communication system, which is embedded in our 16\*2 LED lighting system, was also built to transfer data from the field that is various possible 8 inputs like sensors. This field instruments can vary according to the industry requirement, they may be RTD, Opt coupler, Current transformer or potential transformer. The duplex communication system is not possible in this logger system as it only take inputs from field instruments and data were display on LED system. In this System, We use such field Instruments whose outputs are analog in nature as we are going to log means store this parameter for observation and we can also save this Parameters in the PC for Future Use similar to that of SCADA System. The system Used in this topic are very useful to small Scale industries those who are unable to buy SCADA or fit to those application whose requirement are not as much as high as that of SCADA.

**KEYWORDS:** LM35 temperature sensor, Gas Sensors, Conversion.

## I. INTRODUCTION

In the industry, there are number of sensors are connected to the single machinery to observe the parameter reading or taken by the machinery to generate the proper output from that machine. To get the desire performance of that machine we have to consider various parameter regarding to product also and of machine also. The main focus of this Project is to observe and store the Welding parameter for the product as this is the fast growing technology and market demanded technology. This welding parameter may vary from industry to industry. Instead of welding parameter one can also store other parameter depends on the customer requirements. I have taken welding parameter This is because day by day demand for 2 wheeler, 3 wheeler and 4 wheeler increases rapidly in the market. As we know that different sensor are made for different application and its specification is also different. But how they works that feedback is must and that provision is not given in the industry due to lack of time or there may be other technical reasons.

By taking this concept in the mind I have try to develop such type of Project that help industry to analyze and to store the different reading of the sensors without SCADA so that industry can check the performance of their machine as well as study the effect of parameters variation on their product. This idea also helps industry to reduce the cost for SCADA depending upon their applications. In this type of circuit we can use ADC 0804 which take 8 number of analog input. In this, we used only 3 input to the ADC but we can use maximum 8 numbers of inputs. The basic idea is for 3 inputs 3 different channels were used which are taken inside the AT89c51. It takes the data from particular channel and store in the memory to send or to store on the PC.

PC having the serial communication path that is hyper terminal where we can see that recorded parameters read by the ADC from the different sensors. The required transmission for data sets on the 9600 baud rate which is more profitable

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that shows difference between readings after every 1 sec. on the PC. The bellowed table shows the various parameters that are required for welding. These parameters vary from industry to industry and from job to job.

## II. RELATED WORK

Nowadays, a lot of researchers are working on the development of various production parameters to maintain good finished product so that customer can enjoy his product with satisfaction. The researchers also try to achieve lower power consumption for such process, as it works on DC they also try to work this on AC and has a longer lifetime compared to the SCADA System. In this project, controlling of various production parameters are further try to investigate as it is necessity to also control such parameters in future. A high-speed communication system, which is embedded in our 16\*2 LED lighting system, was also built to transfer data from the field that is various possible 8 inputs like sensors. This field instruments can vary according to the industry requirement, they may be RTD, Opt coupler, Current transformer or potential transformer. The duplex communication system is not possible in this logger system as it only take inputs from field instruments and data were display on LED system. In this System, We use such field Instruments whose outputs are analog in nature as we are going to log means store this parameter for observation and we can also save this Parameters in the PC for Future Use similar to that of SCADA System. The system Used in this topic are very useful to small Scale industries those who are unable to buy SCADA or fit to those application whose requirement are not as much as high as that of SCADA.

Comparison	0808 system	PLC system
Analog Input	8 inputs	2 or 3 inputs
Conversion Time	10 mS	12-15 mS
Power Consumption	5-10 Watt	More than 25 Watt
Maintenance	Less	less Expensive
Cost	Less	Expensive
Back up on PC	Easily monitored	Complicated to monitored

Table 1: System Comparison

The PLC - Data Acquisition System is supplied in powder coated carbon steel enclosures, pre-wired, factory programmed and tested, to trend, monitor, control and display operating parameters. The system includes a separate PC based HMI configured work station and communications bus.

Item	Description
CFM-12	Data acquisition: Agitator speed , wash water flow rate and pH/ORP Control: Cell air flow
Slurry Holding Tank	Data acquisition: Motor operating status and pH
Slurry Feed Tank	Data acquisition: Motor operating status and slurry flow rate to CFM-12 Control: CFM feed pump speed control
Flotation Column	Data acquisition: Slurry level, wash water flow rate and pump speed Control: sparger air flow
Regrind Pin Mill	Data acquisition: Attritor drive speed and motor torque indication
Reagent System	Control: Precision metering pumps, volumetric reagent flow rate, reagent addition (ratio-grams reagent per kg feed)

Table 2: PLC Structure

Data acquisition, data logging and data analysis are required functions for most modern industrial control systems. The simplest and lowest cost way to provide these functions is often by using the same platform that's providing real-time control—namely the PLC or the programmable automation controller (PAC). A few years ago, this wasn't possible as PLCs lacked the required processing power and data storage capability. But more powerful PLCs and the evolution of

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PACs has made it possible to perform many data acquisition tasks within the controller—saving money and providing an overall simpler system. PLCs have been controlling machines and processes for more than 30 years. Demand for data and the need for real-time process information has increased during this time, and continues to grow rapidly in nearly every industry.

End users need intelligence about their processes, machines and manufacturing operations. They need to know about system alarms and events, about process variables, and about production amounts. They need this information to make better manufacturing and business decisions in real time. Historically, acquisition of and access to this information was available only via applications with high-priced standalone supervisory control and data acquisition (SCADA) systems, third-party software, or expensive PC-based systems. But many modern PLCs and PACs now have built-in data acquisition, data storage and networking capabilities so accessing this critical information can be as simple as connecting a PLC’s Ethernet port to a network, or pulling data from a removable USB mass storage device such as a USB pen drive.

### III. SYSTEM DEVELOPMENT

To record data we require following type of circuitry arrangements.

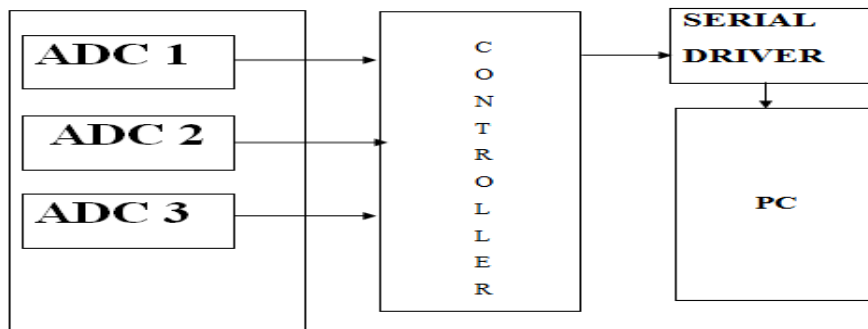


Fig. 1 Basic Block Diagram

Let us understand the working of above circuit. At input of ADC 1, 2, 3 we are going to connect the various sensors whose output are analog. For this purpose we take. LM35, Carbon dioxide sensor and PNP sensor respectively. Output of this field instruments are then given to ADC to convert analog input to digital output for controller. Controller takes this digital data from ADC and displays it on Computer to observe and store the data. There is S-Buff that is serial buffer in the controller which acts like the bus to move data. So at the output of computer or the process, we get the different reading from the field instrument. Here I focus only on 3 parameters but in case of requirement, we can also take 8 input as ADC has 8 pin inputs.

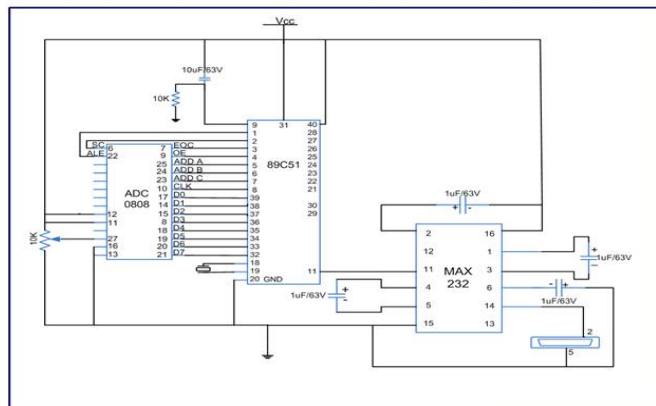


Fig. 2 Circuit Diagram

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## IV. PERFORMANCE ANALYSIS

The proposed project research industrial machineries will be controlled & regulated by the switching actions performed by FFD side. This FFD side also displays the status of the RFD side system on the LCD connected on its panel. Alarm & Indications as shown that corresponds to status monitoring effects on server side due to remote machine parameter dependency. Both the devices will be wirelessly linked by ZigBee with STAR topology. Industrial Automation profile of the ZigBee will be implemented here. As the whole data is transferred via Wireless radio link system will eliminate the loopholes of the traditional wired system. In the proposed module, transmitter module receives the parameters from the device; display parameters on the LCD display and send it to the receiver side through ZigBee connectivity. In the same way receiver module receive data sent by the transmitter through ZigBee connectivity and display it on LCD display connected to the receiver side. Both transmitter and receiver side will generate the alarm if any parameter exceeds its preset value. Thus, it avoids the malfunctioning of the devices due to the variations in the current and voltage parameters and also avoids the system failure.



Fig. 3 Real Implemented System (a) Transmitter module with Zigbee base PCB (b) Receiver Module with Zigbee base PCB.

Figure shows the transmitter and receiver module used in the system. Figure shows the real implemented system. As shown RFD side will be switched by FFD for production controlled mechanisms. Secondly electrical parameters will also be sensed on this side for the purpose of data transmission.

## V. ZIGBEE SYSTEMS

Wireless technology, which has boomed in the IT sector over the past years, can be suitable for industrial control networks as well, providing solutions with high ROI for diagnostics, control and safety.

Wireless Sensor Networks (WSNs) have revolutionized the design of emerging embedded systems and triggered a new set of potential applications. In addition to building automation, environmental surveillance, or military operations Industrial automation is also expected to greatly benefit from WSNs in terms of faster installation and maintenance, cost savings, and easier plant reconfiguration. ZigBee is an emerging short-range, low-rate wireless network technology. ZigBee also presents some potentially interesting features for supporting large-scale ubiquitous computing applications, namely power-efficiency, timeliness and scalability.

In managing the move to wireless, it is clear that common wireless protocols such as Wi-Fi and Bluetooth can be utilized on the factory floor. The challenge is to understand how to utilize wireless solutions, developed for IT applications, as replacements for wired systems in time-critical scenarios typical of factory floor domains. To date, most wireless systems in production systems are focused on applications that require polling frequencies on the order of seconds or longer. However, the fundamental capabilities of these protocols allow support of much higher-speed applications such as motion control and closed loop distributed logic. To address this challenge, the following issues must be addressed in wireless technology for manufacturing: Determining the performance of wireless technology (data rate, transmission, jitter and link reliability)

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## ZigBee Protocol Stack Architecture

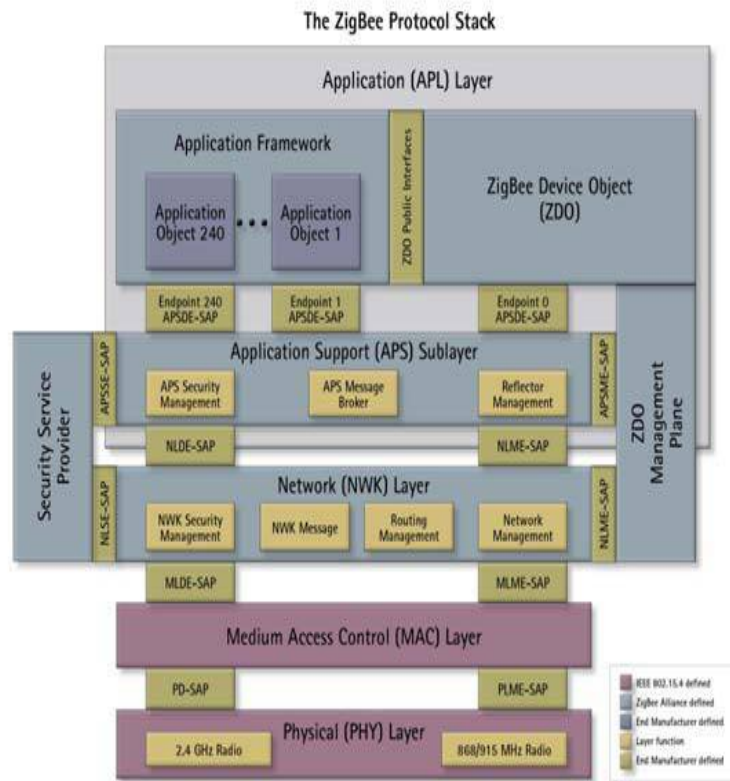


Fig. 4 ZigBee Protocol Stack Architecture

As in figure, ZigBee Protocol Stack architecture shows, three areas of architectural responsibility are in a ZigBee engineering effort.

1. The physical and MAC layers take full advantage of the physical radio specified by IEEE 802.15.4. The 802.15.4 specification describes a peer-to-peer radio using direct sequence, spread spectrum (DSSS). The specification also calls out the data rates, channelization and modulation techniques to be employed.

2. The ZigBee Alliance specifies the logical network, security and application software, which are implemented in a firmware stack. It is the ZigBee networking stack that creates the mesh networking capability. Each microcontroller/RF chip combination requires its own ZigBee stack due to the differences in microcontrollers and RF chips. Typically, the ZigBee stack is included with either the microcontroller or RF chip. The stack may belong to the chip vendor, be provided by the chip vendor from a third-party source, or be provided by a third-party source for a specific microcontroller/RF chip combination.

3. The application layer is defined by profiles, of which there are two types: public profiles are those certified by the ZigBee Alliance for interoperability purposes, and private profiles are for use in closed systems.

## VI. ADVANTAGES AND DISADVANTAGES

### Advantages:

1. All Zigbee compliant appliances are compatibly operate on the same network.
2. Setting up zigbee wireless home management system is relatively inexpensive.
3. Ability to manage home appliance network remotely.



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4. Elements depends on infrared devices.
5. No central control point dispersal of workload.
6. Simple circuit design.
7. Range is higher than Bluetooth upto 100 meter.
8. Pairing between receiver and transmitter is not required.

Disadvantages:

1. Limited range *i.e* 100 meter.
2. Replacement with zigbee compliant appliances can be costly.
3. No more secure than a typical 802.11 wireless network

## VII. CONCLUSION

It has been shown that even though most existing efforts are still in a very early stage, Parameter logging is a promising technology with a wide prospective applications. An ever-growing interest in parameter logging throughout the world can be expected to lead to real-world applications in the future. In some of application it poses a favorable alternative to conventional solutions (SCADA). The main goals for the future are increasing the transmission rate and improving standardization.

It is possible to improve the transmission rate through duplex communication completing standardization is challenging in that technical requirements and other regulations, such as safety and Operations constraints, have to be combined.

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