PLC Design of Automatic Bell Ringing System along with SCADA

Arjun M
SRM Alumni

Abstract: **There are lot of time deviations found in various Industries and educational researchers due to delay in bell ringing occurred due to human errors. To overcome this issue , this work comes up automating this process for remove the delay in the process. To bring this into the schedule with accuracy the work proves with a design of bell ringing or alarming system with 24 hours clock using Programmer Logic Controller (commonly known as PLC). To check the control for multiple area we have used Supervisory Control And Data Acquisition system. But, this work shows with a single system. We have neglected cost in the work , to account for accuracy of bell ringing.**

Keywords: PLC – Programmable Logic Controller, SCADA – Supervisory Control And Data Acquisition

1.0 INTRODUCTION:

In several Industries , educational institutions , clock towers fails to maintain accuracy and lacks flexibility of bell ringing. This work overcomes these difficulty without taking cost into account by considering time accuracy and bell ringing or alarming. This work uses a switch , 24 clock , Comparator and Bell in the design. This work uses PLC and output can be seen through SCADA. This can replace alarms , bells , tower clocks or industrial bells. But, automating this process and using bells over many areas controlled from control room in SCADA. It reduces the man-power for ringing the bell manually in many areas. Huge mechanical architectures for bells occupy huge area whereas this replaces it by being compact in size with more repeatable accuracy along with precision in time of ring the bell.

2.0 LITERATURE SURVEY:

Dhanraj Shiv, Kamal Niwaria has proposed in their work titled "A study of Programmable Logic Controller and Graphics User Interface : A Survey" used PLC as the heart of the automation. The use of SCADA with PLC was said in detail. It depicted about the use of Ladder Diagram in PLC programming. Ladder Logic used in this work were by softwares RS Linx, RS Logix 500 and SIMATIC Manager. SCADA used in this work is Wonderware InTouch..

Niharika Thakur and Manisha Hooda has proposed in their work titled " A review paper on PLC &; its application in Robotics
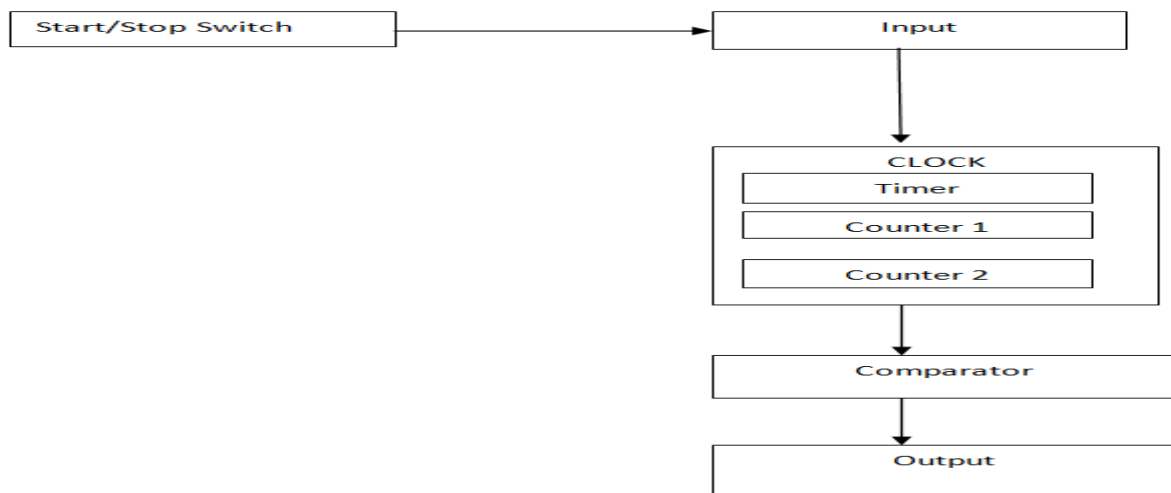

Fig: Block Diagram of Automatic Bell Ringing System using PLC

and Automation" about the introduction of PLC and basic hardware explanation in details. Types of programming available in PLC to program it in a suitable way to program a PLC. This helped in short listing Ladder is the way to program the PLC in the required manner.

Shoba S and Ramachandaran has proposed in their work titled "Realization of Timers, Counters and Shift Registers for Programmable Controller Using Ladder Diagram" that in ladder basic element is a contact. The open contact holds the current whereas closed contact allows the current to flow through next element. Controller timer and counter are internal instructions that provide the same function hardware timers and counters. Timer activate or deactivate a device after a time interval has expired or preset has reached. Counter is used to count the external events fed from the respective inputs.

There are two types of models how timer is designed. Timer can be symbolic functional block or a parallel

automata. In parallel automata, internal clock is used to set the timer. In this work, timer block is used and later timer function is called.

The power of the controller lies in scheduling the timely events and maintaining the precise time between the events.

Exactly, counter block is the available instruction block in the ladder logic program that allow the occurrences of the input signals or the events to be counted.

Up and down counter will be operated in counting the inputs from bottom to top and top to bottom respectively.

Liping Guo has proposed in their work titled " Design projects in a programmable logic controller in Electrical Engineering Technology" about one shot pulse (ONS). Work has described the use and learning ONS instruction in PLC Ladder Logic Programming. It is one pulse which is a rising pulse.

3.0 ELEMENTS USED IN THE WORK:

3.1 PLC
3.1.1 ONE SHOT RISING (ONS)
One shot Rising is used to control a process. It controls by giving a rising pulse to the active.
element. OSR requires two bits to operate.

3.1.2   COMPARATOR
Comparators are used to compare 2 functions.
Types of comparators available are Greater than, lesser than, Equal to, Greater than or equal to, lesser than or equal to etc.
This work uses Equal to block to compare 4 times as bell need to ring 4 times with 2 times in each rung.
It compares the clock with of minute and hour counter and activates a memory.
This memory makes the bell to ring.

3.2 SCADA
There are two fixture switches.
It is used to start and stop the program.
Start and stop are memory in the PLC program.
Round Siren glows when bell is rung using PLC.
Inputs and Output are monitored using Wonderware In-touch SCADA.

3.2.1   SWITCHES
Switches are having 2 modes.
Fixture switches are used in this.
One mode is on and other is off.
This work uses 2 switches to operate in the SCADA.
Address of the switches used in PLC are used in SCADA .

3.2.2   LIGHTS
The light used in this work is round siren.
Output address of PLC is used in the SCADA.
It is the load of PLC or the bell.
When it shows green, it means Siren is on and when it shows red , it means siren is off.

4.0 THE DESIGN:

We started with basic designing of the start rung .
Input switch for starting the PLC
Stopping the PLC is by using the make switch.
Memory is used to give a signal to switch on and it is indicated in SCADA.
Memory to start the PLC and to stop the PLC .

We have made three rungs to design a twenty-hours clock.
Used a memory to switch on the timer. It uses the NO switch to start. This timer indicates seconds hand in a clock.
Called the counter using NC switch to reset the On Delay Timer. Counter uses the address of the counter bit to allow the signal .
When the signal passes called counter switch, On – Timer is enabled and accumulator bit in the timer runs till the preset.
This work has called the done bit of the timer to make the counter count. Once after 60 minutes, the counter resets using One Shot Rising after a cycle.
This resembles the minute hand of the clock.
Done bit of the timer enables the up- Counter. One shot rising pulse is a instruction, which rising pulse of one shot. And it enable the up counter.
The accumulator counts down till 60 for every 60 seconds in the timer.
Counter's accumulator counts for every 60 seconds till the preset reaches 60 minutes.
It stops counting after 60 minutes and then hour preset goes to one.
The counter 1 and timer 1 starts a new cycle.
Done bit of the counter enables the counter 2 to count.
The accumulator bit of the counter enables the counter 2 to count.
It counts or increment for every 3600 times cycle ,or 60 minutes counts of counter.
The accumulator bit counts 24 times till it reaches the preset bit.
Entire, counter 2 resets. Preset bit and accumulator bit reaches 0 and resets.
It resets the timer 1 and other 2 counters.
The whole clock reset by this process.
Timer gets reset by the counter 1 bit whereas counter gets reset by its reset bit.

4.1 RESET PROCESS OF 24 HOURS CLOCK
Done bit of the counter with the counter address , done bit (counter 1) is called in Normally Open switch.
Using that Reset Instruction, counter 1 is reset.
Done bit of the counter with counter address done bit (counter 2) is called in Normally Open switch.
Using that Reset Instruction, counter 2 is reset.
One shot rising is should for the overall reset.
Done bit of the Timer with timer address 's done bit (timer 1) is called in Normally Open switch.
Using that Reset Instruction, timer is reset.

This completes the whole process of 24 hours clock and cycle continues as along the existence of power in the circuit and proper functioning.

4.2 COMPARING THE CLOCK WITH COMPARATOR TO ACTIVATE THE MEMORY

There are two comparators.
First one is for minute hand and Second one is for hour hand.
Comparator block used here is equal to block.
It compares with set value with the time and when it is equal. It enables the memory.

It could be set for a particular time in 24 hours. This rung could be repeated for several times within a program to activate a memory for which the bell has to ring.

4.3 RINGING THE BELL USING MEMORY

Four memories are used in this rung.
Each memory corresponds to the time it rings the bell as output.

4.4 VISUALING THE CONTROL IN SCADA

The input and output of the PLC system of BELL can captured , operated and controlled using a fixture switch . The output status can be known from the siren bulb.

5.0 INFERENCE:

Automatic Bell Ringing System is designed in RS Logix 500 using Ladder Diagram and inputs , and outputs of PLC are monitored in SCADA using Wonderware Intouch. This is useful in place where automatic bell ringing is necessary or alarm system required for particular time in 24 hours for every day.

6.0 REFERENCES:

[1] *6.1* Dhanraj Shiv, Kamal Niwaria has proposed in their work titled "A study of Programmable Logic Controller and Graphics User Interface : A Survey" in IRJET in Issue 5 in May 2018.

[2] 6.2 Niharika Thakur and Manisha Hooda has proposed in their work titled "A review paper on PLC & its application in Robotics and Automation" in IJIRCEE in Vol 4, Issue 4, August 2016.

[3] *6.3* Shoba S and Ramachandaran has proposed in their work titled "Realization of Timers, Counters and Shift Registers for Programmable Controller Using Ladder Diagram" in IJSER in Vol 7, Issue 4, April 2016.