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Advancement in Home Appliance Automation Using PLC

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Abstract : *This paper deals with the home automation using PLC. In this project home appliances are automatically control by using PLC for energy saving purpose. This project includes many sensors for various applications. Temperature sensor which is interfaced to PLC as the temperature exceeds certain temperature the fan will turn on and also the speed of fan will be controlled depending on temperature and level sensors used for controlling the level of water of the tank. Also the DTMF is used for door latch system. The real time system developed is highly effective, efficient and robust. The concept of home automation is to connect all the systems and devices so that it can be controlled from anywhere.*

Key words: Home Automation, Ladder programming, Programmable logic controller, Sensors, DTMF

1.INTRODUCTION

PLC (Programmable Logic Controller) is more or less a small computer with a built-in operating system (OS).This OS is highly specialized and optimized to handle incoming events in real time, i.e. at the time of their occurrence. The PLC has input lines, to which sensors are connected to notify of events. (Such as temperature above/below a certain level, liquid level reached, etc.) and output lines, to which actuators are connected to effect or signal reactions to the incoming events (such as start an engine, open/close a valve, and so on). PLC is very powerful and smart electronic device that can automatically control electrical appliances. Execute a user defined logic program, and write the resulting digital and analog output values to various output elements[1]. In this project "Advance home automation using PLC" mainly deals with the controlling of home appliances such as fan, with change in temperature the speed of fan changes, which also saves energy. The DTMF decoder circuit decodes the key press by the mobile to generate the bit data which is given to PLC which will unlock the door latch further. Also level sensors are used to control the level of the tank which as well reduces the wastage of the water.

2. LITERATURE SURVEY

Many papers have referred for this project. The paper title" Overview of Automation Systems and Home Appliances Control using PC and Microcontroller" [2].In this paper the automation of home appliances are control by using PC or microcontroller. But the PLC has lot many advantages over microcontroller i.e direct interoperability to other industrial devices such as relays, valves, actuators, transmitters, motor starters, VFDs, HMIs. PLC'S are more reliable in harsh industrial environments of high temperatures, humidity & chemicals. It is more suitable for real time applications. Another paper title" PLC based home automation System"[3]. This paper helps to choose lot many applications such as level detector, door latch system etc.

The paper title" Implementation of Home Automation Safety Control Using Programmable Logic Controller"[4]. In this paper relay based automation overcomes the problem of manual processes. For better switching purpose they use relay based automation. But this too has few disadvantages such as bulky wire arrangement and troubleshooting is also difficult. A normal relay based automation control panel comes in formation of low pressure, high pressure, low temperature, high temperature, over voltage, under voltage, over current, under current, short circuit and earth fault.

3. SYSTEM DESIGN

The system design includes two part hardware implementation and software implementation. The system block diagram is as follows.

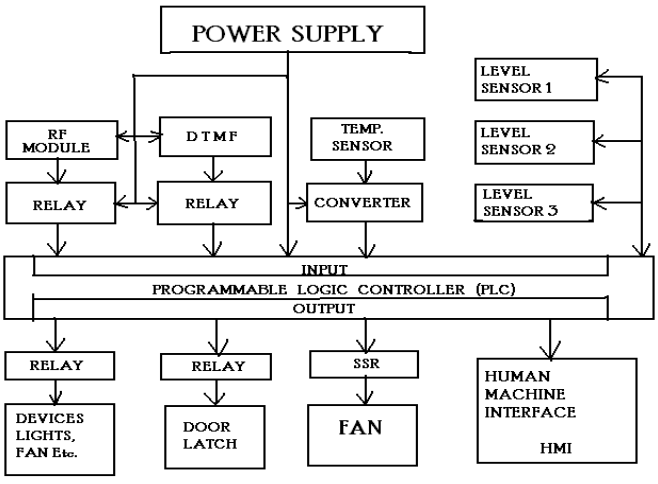

Fig.1 Basic block diagram of system design

The simplified block diagram for Advance Home Automation Using PLC is given in Fig.1 . In this block diagram AC supply given to SMPS, which is used to convert 230V AC into 24V DC, 24V DC supplied to PLC. In this project we are using A PLC (DVP 10-SX) is a device that detects events or changes in quantities and provides a corresponding output. It provides like door control, water level control of tank, home appliances control and so on. The control system is an intelligent network of electronic devices, designed to monitor and control the mechanical and lighting system. The PLC is a purpose-built machine control computer designed to read digital and analog inputs from various sensors, execute a user defined logic program, and write the resulting digital and analog output values to various output elements. In this project, temperature sensor is used because of we are taking the temperature of the room. On this temperature signal we are turn on the fan and also change the speed of fan with respect to the changing the room temperature and then this signal is provided to the converter. Which converts the signal of temperature sensor according to the change in resistance we takes 0-10V signal from the convertor and then the output of convertor is providing to the PLC. PLC is used for the monitoring to the Solid State Relay (SSR) and then 0-10V from converter is gives to SSR which gives the output 0-230V AC. Then the output of SSR is given to the fan. DTMF decoder circuit identifies the dial tone from the one mobile phone and decoded data which is in bit is given PLC accordingly PLC will control the relay in the circuit which further controls the door latch . By using the IC MT8870 which is a touch tone decoder IC, it decodes the input of DTMF to digital output. This IC uses a digital counting technique to determine the frequencies of the limited tones and to verify that they correspond to standard DTMF frequency. It gives one way communication between the dialer and the mobile phone exchange. Limit Switch is monitors and indicates the movement of water. Limit Switch triggers the contact From the readings of limit switch motor is ON/OFF by PLC.

3.1 Hardware Implementation

PLC Controller (DVP 10 - SX): A Programmable Logic Controller PLC for short is simply a special computer devices used for industrial control systems. They are used in many industries such as oil refineries, manufacturing lines, conveyor systems and so on. Where ever there is a need to control devices the PLC provides a flexible way to software the components together. Figure Basic Block Diagram of PLC the basic units have a CPU (a computer processor) that is dedicated to run one program that monitors a series of different inputs and logically manipulates the outputs for the desired control. They are meant to be very flexible in how they can be programmed while also providing the advantages of high reliability (no program crashes or mechanical failures), compact and economical over traditional systems. Here the block diagram of PLC is Shown. The DVP-SX series is a 10-point (4DI+2DO+2AI+2AO) special main processing unit. Besides the same commands and functions as DVP-SA/SX/SC series, 2-CH 12-bit analog voltage/current input and 2-CH12-bit analog voltage/current output are all bipolar. There is built-in 2-digit 7-segment display corresponds to internal register directly to display PLC station or nurse-defined code.

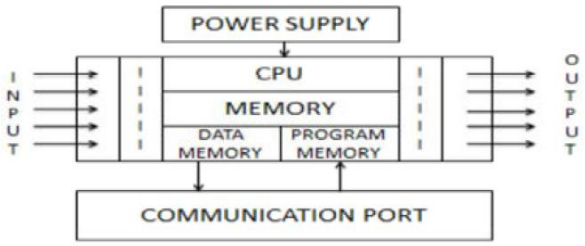

Fig 2 Block Diagram of PLC

DTMF (MT8870): DTMF stands for Dual Tone Multi Frequency. It is used in analog telephone system for signaling It is better known as Touch tone. For DTMF signaling there is always a keypad .When you press a button on the keypad a path is completed and generates two different tones simultaneously one is row tone another is column tone .In telephone system after each button pressed a row tone and column tone is send to telephone exchange they decodes these tones and identifies which number is pressed by dialing these tones and switch your call to the number the same thing is done by receiver circuitry to identify the calling number. For each column and each row a unique frequency is assigned the figure bellow shows how they are assigned to the rows columns let's take an example suppose we have pressed 7 so the row toned at 5volts oscillator is of 3.579545MHz . Here is the pin diagram of DTMF in Fig.3.

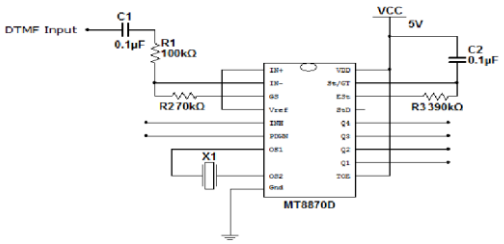

Fig.3 PindiagramofDTMF

Temperature Sensor (Pt100): An RTD is a device which contains an electrical resistance sourcewhich changes resistance value depending on it's temperature. This change of resistance with temperature can be measured and used to determine the temperature of a process or of a material.RTD (Resistance Temperature Detector) temperature sensor100 ohm ResistancePlatinum RTD – 3 Wire ¼" Diameter3 – Wire RTD element encased in alumina powder insulation provides excellent vibration damping and heat trasfer Better Accuracy

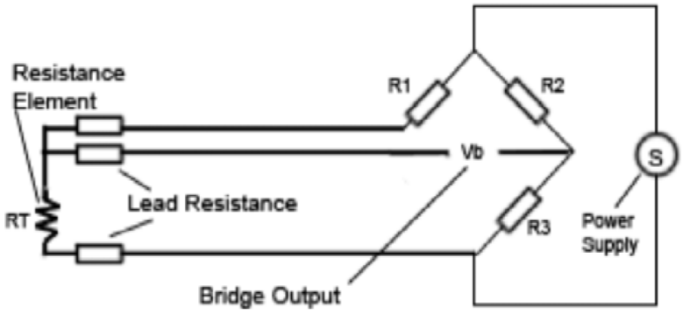

Fig.4.Brigde arrangement of RTD

3.2 Software Implementation

Ladder diagram: It is an automatic control diagram language that developed during World War II. At first, it just has basic components, such as a contact (normally open), B contact (normally close), output coil, timer counter and etc. The working principles of the traditional Ladder Diagram and the PLC Ladder Diagram are similar to each other; the only difference is that the symbols for the traditional ladder diagram are expressed in the format that are close to its original substance, while those for the PLC ladder diagram employ the symbols that are more explicit when being used in computers or data sheets. In the Ladder Diagram Logics, it could be divided into the Combination Logics and the Sequential Logics. Ladder logic is widely used to program PLCs, where sequential control of a process or manufacturing operation is required. As PLCs became more sophisticated it has also been used in very complex automation systems. Development and maintenance is simplified because of the resemblance to familiar relay hardware systems. Manufacturers of PLCs generally provide associated ladder logic programming systems. Ladder logic can be thought of as a rule-based language rather than a procedural language. A "rung" in the ladder represents a rule. When implemented with relays another electromechanical devices, the various rules "execute" simultaneously and immediately. When implemented in a programmable logic controller, the rules are typically executed sequentially by software, in a continuous loop (scan). By executing the loop fast enough, typically many times per second, the effect of simultaneous and immediate execution is achieved, if considering intervals greater than the "scan time" required executing all the rungs of the program. The green line represents Ladder and the blue line is called a Rung. If any switch is pushed ON then it also turns green. By visualizing the change of state of switches in software real time response of the system is monitored online. Any switch can be forced or actuated through the software.

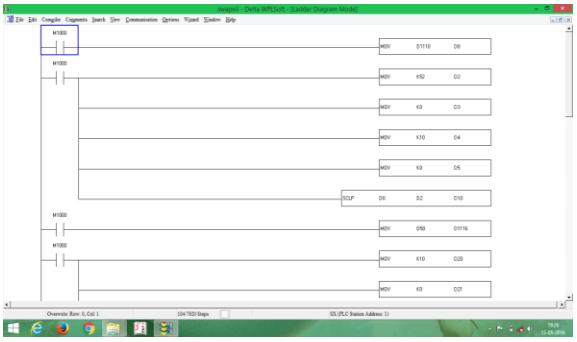

Fig.5 Ladder Programming for temperature sensor

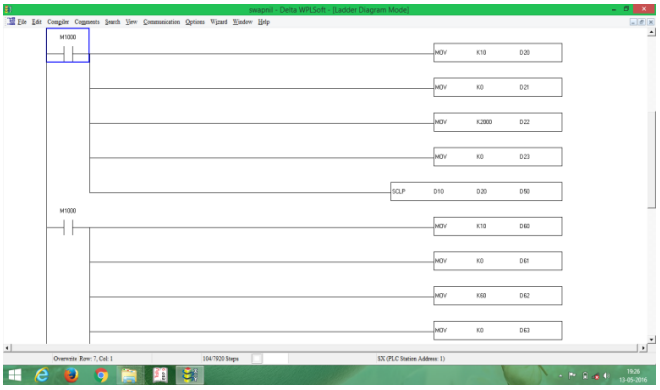

Fig.6 Ladder Programming for door latch

6. RESULTS

When the temperature is above 40°then fan is ON. But in our project we connect bulb as a fan. When the temperature is above 40° C then bulb is ON. It is shown in Fig 6.

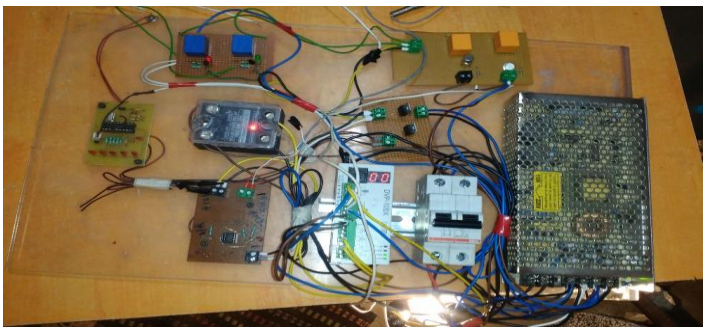

Fig.7 Output of temperature sensor

When the level of the water is below the bottom level Green LED indicator indicates. Then motor is ON. When water is touches top level of water tank then the Red LED is glow then automatically buzzer is ON and motor is OFF. That is indicated as water tank is full. It is shown in Fig.7.

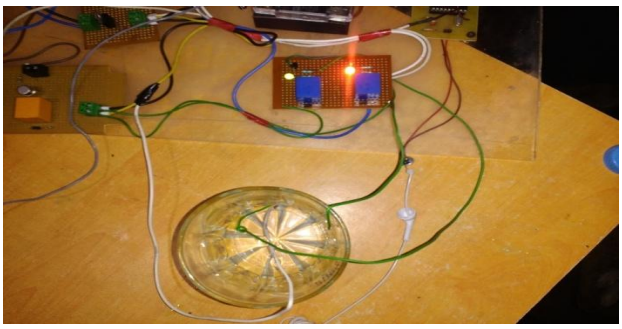

Fig. 8 Output of water level indicator by PLC

7. CONCLUSION AND FUTURE SCOPE

7.1 Conclusion: This project is based on the programmable logic controller (PLC). Temperature sensor will help to the monitor ideal temperature more accurately. As detect the correct temperature the fan gets on this is better over the traditional system also if the correct number is pressed then an then only the door latch is open this will increases the security home also because of the providing the limit switch in water tank the buzzer is on so we can prevent the wastage of water.PLC is much better when compared to relay based advantage is that, it consumes less power, low maintenance cost, can be programmed. Thus, productivity increases.

7.2 Future scope: System can be modified to give advanced automation using specified and suitable sensor. Further the system can be made wireless so that it can be accessed remotely therefore the system can be implemented in remote location. Furthermore it can be modified with the Bluetooth technology so that it can be accessed with smart phones.

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