A Microcontroller Based Industrial Timer

Deepak Kumar
Deepakbeniwal3002@gmail.com
M. Tech Scholar, Department of Electrical & Electronics Engineering, BRCM CET, Bahal, (Haryana), India
Dr. Vivek Kumar
Hodeee@gmail.com
Professor & Head, Department of Electrical & Electronics Engineering, BRCM CET, Bahal, (Haryana), India

ABSTRACT

The proposed digital timer system is implemented and tested for the desired functionalities. The system is highly reactive for these faults and responds in real time. The voltage and current high and low thresholds can be set to define the range of safe operation for the transmission line. The user can rely on this system as it ensures the complete protection of the line against these faults by switching a relay accordingly. All the calculations and decision making are carried out by a high performance eight-bit microcontroller. The system is tested and calibrated many times to get the optimum results. Up-gradation and optimization of this system is possible and open for further experimentations.

Keywords: IoT, Web server, NodeMCU, Home Automation

INTRODUCTION

As it is a programmable device so there is a requirement for hardware components and tools to prepare the physical prototype and to make it work software tools are also required for editing, compiling, debugging, testing, of source code and burning that code into the microcontroller. As an online rapid prototyping platform TinkerCad is preferred. To obtain the desired results and design schematic Proteus is used. Microcontrollers are much more paired back devices, which typically use a combination of a processor, small amounts of memory and some on-board peripherals to carry out instructions given to a larger system. They are usually much smaller and cheaper than a computer and they usually use a lot less power. They are great for specific designed tasks. In the household appliances and the electronic devices used in our daily life there are various integrated circuit boards. The parts on the circuit boards enable electronic products to have multiple functions. Among the integrated circuit boards, the most important part is the microcontroller which is an integrated circuit chip having a central processing unit (CPU) with data processing capabilities, memory and multiple input output interfaces.

The timers can be used as a multi-functional device which can provide real-time alerts, generation of duty-cycle for the application of pulse width modulation, on-time control, off-time control. As every process these days are basically time bound processes and such time bound process if properly monitored and controlled initially can provide promising results while increasing the overall production in industries. So, timers are basically referred to a device that keeps an account of time in seconds, minutes or hours. Timers have always proven to be the most critical component of an automation system specifically in those systems where the process handling by machines is purely dependent upon time.

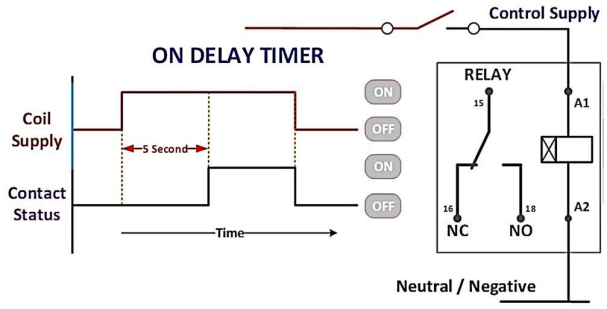

Figure-1: On-Delay Timer Circuit

There are multiple timers deployed around we come across in our day-to-day life. It is such an essential component today that

we as humans cannot think beyond living without timers. Timers can be found in Lighting, Appliances, Washing Machines, Microwave Ovens, Traffic Lights, Sprinkler Systems, Induction heaters, Geysers, Stop watch, etc. Timers can be further classified as mechanical timers and electronic timers. The objective is to design and develop a microcontroller based integrated on-off delay timer relay. The timer must be designed in such a way that it could be configured easily by the user at any instant of time with the help of some push button.

IMPLEMENTATION

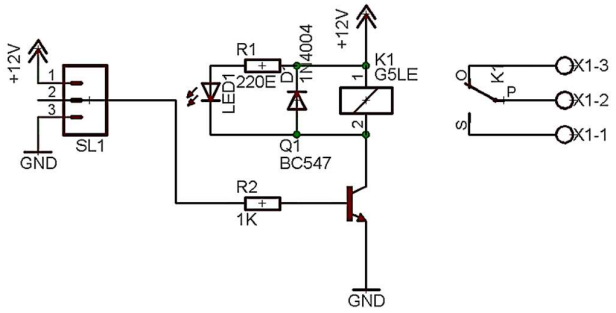

Figure-2: Relay Interfacing Circuit

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. Relays are the components which allow a low-power circuit to switch a relatively high current on and off, or to control signals that must be electrically isolated from the controlling circuit itself. To make a relay operate, we have to pass a suitable pull-in and holding current (DC) through its energizing coils. Generally, relay coils are designed to operate on a supply voltage often 12V or 5V.

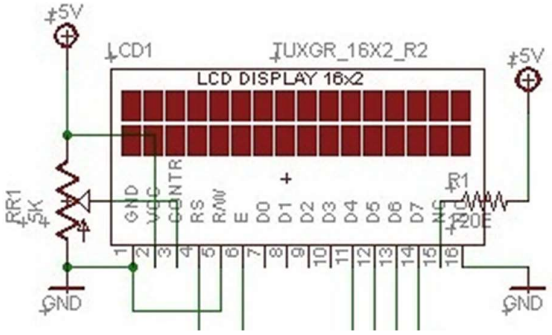

Figure-3: LCD Interfacing Circuit

The display used here was a 2x16 line alphanumeric LCD module. Here it was operated in 4-bit mode therefore just 4-bits of the LCD data bus were interfaced with the microcontroller pins (Pin No. 14,15,16,17) and the rest four were left unconnected. There are three control signals for an LCD, out of which Read/Write pin is permanently grounded to keep it permanently in write-mode only and other two pins i.e. Register Select pin and Strobe Enable pin were interfaced with the microcontroller (Pin No. 19, 20). The LCD needs +5V DC power to operate. The characters displayed on the LCD are in ASCII format only.

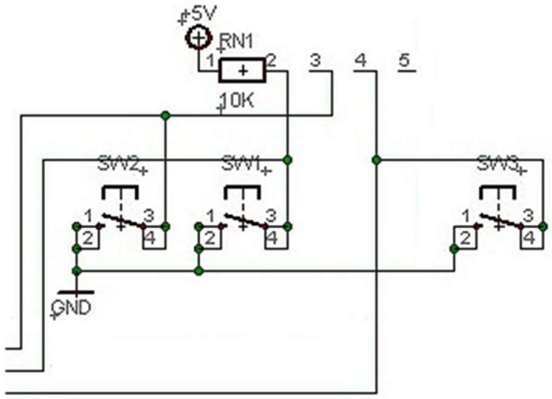

Figure-4: Push Button Interfacing Circuit

This section was responsible for the system re-configuration. The system was designed to operate with some default fixed values for each cut-off state. The system was made flexible for the user as three push button keys were provided on board to alter these default values. One key was to select mode whose value needs to be altered. When these mechanical switches are pressed or released, the contacts often rebound or bounce back several times before settling down to stable state and this would lead to false or multiple key press/ release detections. To deal with such situation a lot of hardware as well as firmware level solutions are available. Here in this work the ambiguity was solved at firmware level only by ensuring just single key press/ release within a given time slot usually in milliseconds. This process is known as key-debouncing. The key press detection is purely interrupt driven and not polling based to prevent unnecessary engagement of the processor. The touch button is the most widely used electric, electronic, and panels mechanical switching mechanism. The tiny switches are put on PCBs and

are applied when someone presses the button to close an electric circuit. If the key is pressed, the switch turns ON and the switch switches OFF when the button is released. The switch provides an input message to actuate a device or equipment, generates an interruption, manually increases or decreases the value, as a key on the matrix keyboard, changes the mode of operation of a device. At order to avoid the detection of false triggers when the line is in high impedances, a pull-up resistor is interfaced to the switch line.

EXPERIMENTAL RESULT

The proposed system is implemented and tested for the desired functionalities. The system is highly reactive for these faults and responds in real time. The voltage and current high and low thresholds can be set to define the range of safe operation for the transmission line. The user can rely on this system as it ensures the complete protection of the line against these faults by switching a relay accordingly. All the calculations and decision making is carried out by a high performance eight bit microcontroller. The system is tested and calibrated many times to get the optimum results. Up-gradation and optimization of this system is possible and open for further experimentations.

CONCLUSION

These types of systems are always open for further optimizations. Optimization by selecting the more precise and accurate algorithms, optimizations in the firmware is possible. This system can be modified as per the application and as per the user requirement. It can be integrated with any other system as a plug-n-play device to control the switching operation of that particular system. Use of more advanced techniques is left open for the future. Through this proposed work we came to know about the utility of configurable on-delay and off-delay timer to control the switching of a relay intended to control a sequential process. The system has been tested for different on-delay and off-delay timer values and calibrated through modifications in hardware as well as software. Relay has been the key element to turn ON and OFF according to these time limits set by the user. This system can be integrated as a part of a more sophisticated systems where to maintain a controlled time environment.

REFERENCES

[1] Dilip Kumar Sharma; Neeraj Baghel; Siddhant Agarwal, “Multiple Degree Authentication in Sensible Homes based on IoT Device Vulnerability”, 2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), IEEE.

[2] Satyendra K. Vishwakarma; Prashant Upadhyaya; Babita Kumari; Arun Kumar Mishra, “Smart Energy Efficient Home Automation System Using IoT”, 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU), IEEE.

[3] Kabita Agarwal; Arun Agarwal; Gourav Misra, “Review and Performance Analysis on Wireless Smart Home and Home Automation using IoT”, 2019 Third International conference on I-SMAC (IoT in Social, Mobile, Analytics, and Cloud) (I-SMAC), IEEE.

[4] Tushar Chaurasia; Prashant Kumar Jain, “Enhanced Smart Home Automation System based on Internet of Things”, 2019 Third International conference on I-SMAC (IoT in Social, Mobile, Analytics, and Cloud) (I-SMAC), IEEE.

[5] Tui-Yi Yang; Chu-Sing Yang; Tien-Wen Sung, “A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System”, 2016 Third International Conference on Computing Measurement Control and Sensor Network (CMCSN), IEEE.

[6] Whether heated A. Jabbar; Mohammed Hayyan Alsibai; Nur Syaira S. Amran; Samiah K. Mahanadi, “Design and Implementation of IoT-Based Automation System for Smart Home”, 2018 International Symposium on Networks, Computers, and Communications (ISNCC), IEEE.

[7] Shradha Somani; Parikshit Solunke; Shaunak Oke; Parth Medhi; P.P. Laturkar, “IoT Based Smart Security and Home Automation”, 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), IEEE.