JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Multiple Load Controller for Industry

[1]Rajat Tiwari, [2]Shivam Singh, [3]Prashant Mishra, [4]Aniket S Falke,

[5]Dr. Abhijeet Gupta

[1-4] Research Scholar, [5] Professor
Department of Electronics &Communication Engineering,
Lakshmi Narain College of Technology and Science, Bhopal

Abstract: In the realm of industrial automation, the efficient management of multiple loads is crucial for enhancing productivity and ensuring optimal resource utilization. This project proposes the design and implementation of a sophisticated Multiple Load Controller (MLC) tailored to meet the dynamic demands of modern industrial setups. The MLC system aims to streamline the operation of diverse loads within an industrial environment, ranging from motors and pumps to heaters and lighting systems. By integrating advanced control algorithms and cutting-edge hardware components, the MLC offers a comprehensive solution for orchestrating the power distribution and consumption across various equipment. Key features of the proposed MLC include real-time monitoring capabilities, adaptive load balancing, and intelligent fault detection mechanisms. Through the utilization of sensor networks and data acquisition modules, the controller gathers comprehensive data regarding load characteristics, energy consumption patterns, and operational parameters. This data serves as the foundation for dynamic load management strategies, enabling the MLC to optimize energy usage and minimize wastage effectively

Index Terms - Work Flow, Circuit Details, Working

1. INTRODUCTION

The industrial landscape stands on the precipice of transformative change, driven by the relentless pursuit of efficiency, sustainability, and operational excellence. As industries navigate the complexities of modern production processes, the effective management of energy consumption emerges as a paramount concern. In this pursuit, the advent of sophisticated control systems offers a beacon of hope, promising to revolutionize the way industrial facilities harness and distribute energy across myriad equipment and processes. Central to this paradigm shift is the concept of a Multiple Load Controller (MLC) system—a cutting-edge solution designed to orchestrate the operation of diverse loads within industrial settings with precision and efficiency.

1.1 Contextualizing Industrial Energy Management: Industrial operations represent a tapestry of interconnected processes, each demanding its share of electrical power to drive machinery, facilitate production, and sustain critical operations. From motors and pumps to heating systems and lighting fixtures, the constellation of loads within an industrial facility presents a formidable challenge in terms of energy management. Traditionally, industrial energy consumption has been characterized by inefficiencies, wastage, and suboptimal resource allocation, leading to high operational costs and environmental concerns. Moreover, the dynamic nature of industrial processes exacerbates these challenges, as fluctuating demand patterns and evolving operational requirements demand a nimble, adaptive approach to energy management. In this context, conventional control systems often fall short, lacking the granularity and sophistication required to navigate the intricacies of modern industrial environments. As industries grapple with the imperatives of sustainability, regulatory compliance, and operational resilience, there arises an urgent need for innovative solutions capable of harmonizing energy supply and demand with precision and foresight.

1.2 The Emergence of Multiple Load Controller Systems: At its core, the MLC system embodies the principles of real-time monitoring, adaptive control, and intelligent decision-making, empowering industrial facilities to optimize energy usage, mitigate wastage, and enhance operational efficiency across the board. The genesis of the MLC concept can be traced back to the burgeoning field of smart grid technology, where researchers and engineers sought to devise novel solutions for managing distributed energy resources in a dynamic, interconnected manner. Drawing inspiration from advancements in

power electronics, communication protocols, and computational intelligence, the MLC paradigm represents a convergence of diverse disciplines, ranging from electrical engineering and computer science to control theory and data analytics.

1.3 Key Components and Functionality: Central to its architecture are sensor networks, data acquisition modules, and communication interfaces that enable seamless integration with existing infrastructure and equipment. By harnessing the power of real-time data, the MLC system gains unparalleled insight into load characteristics, energy consumption patterns, and operational dynamics, laying the groundwork for informed decision-making and proactive intervention. Moreover, the MLC system boasts a suite of advanced control algorithms and optimization techniques designed to maximize energy efficiency while ensuring operational robustness and reliability. Through adaptive load balancing, predictive maintenance, and fault detection mechanisms, the system can dynamically adjust load profiles, preempt equipment failures, and mitigate downtime, thereby enhancing overall productivity and asset utilization.

2. WORKING

The Multiple Load Controller (MLC) system, equipped with two DC motors, a microcontroller, a Bluetooth module, and MOSFETs, represents a sophisticated yet versatile solution for wireless control of motor speed based on Bluetooth commands. Let's delve deeper into how each component interacts within the system and the overall working principle:

2.1 Bluetooth Module: Acting as the bridge between the user interface and the MLC system, the Bluetooth module facilitates wireless communication between a smartphone or any Bluetooth enabled device and the microcontroller. It receives commands transmitted from the user's device and forwards them to the microcontroller for processing. Commands may include instructions to adjust motor speed, change direction, or stop the motors altogether. The Bluetooth module ensures seamless connectivity and enables users to control the MLC system remotely.

2.2 Microcontroller (IC): At the core of the MLC system lies the microcontroller, which serves as its brain. The microcontroller receives commands from the Bluetooth module and processes them to determine the required RPM (revolutions per minute) for the DC motors. This processing involves interpreting the received commands, converting them into motor speed settings, and generating corresponding control signals. Depending on the specific commands received, the microcontroller adjusts the PWM (Pulse Width Modulation) signals sent to the MOSFETs to regulate the power supplied to the DC motors accurately.

2.3 DC Motors: The MLC system is equipped with two DC motors, each performing specific tasks depending on the application. These motors may be used in various industrial, automotive, or robotic applications, such as driving wheels, conveyor belts, or robotic arms. The microcontroller controls the speed of these motors by adjusting the voltage and current supplied to them through the MOSFETs. By varying the PWM signals sent to the MOSFETs, the microcontroller regulates the speed of the motors, allowing precise control over their operation.

2.4 MOSFET: MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors) serve as switches that control the power supplied to the DC motors. The microcontroller sends PWM signals to the MOSFETs, which, in turn, regulate the voltage and current flowing to the motors. By adjusting the duty cycle of the PWM signals, the microcontroller controls the average voltage applied to the motors, thereby controlling their speed. MOSFETs play a crucial role in efficiently switching power to the motors.

2.5 Circuit Diagram:

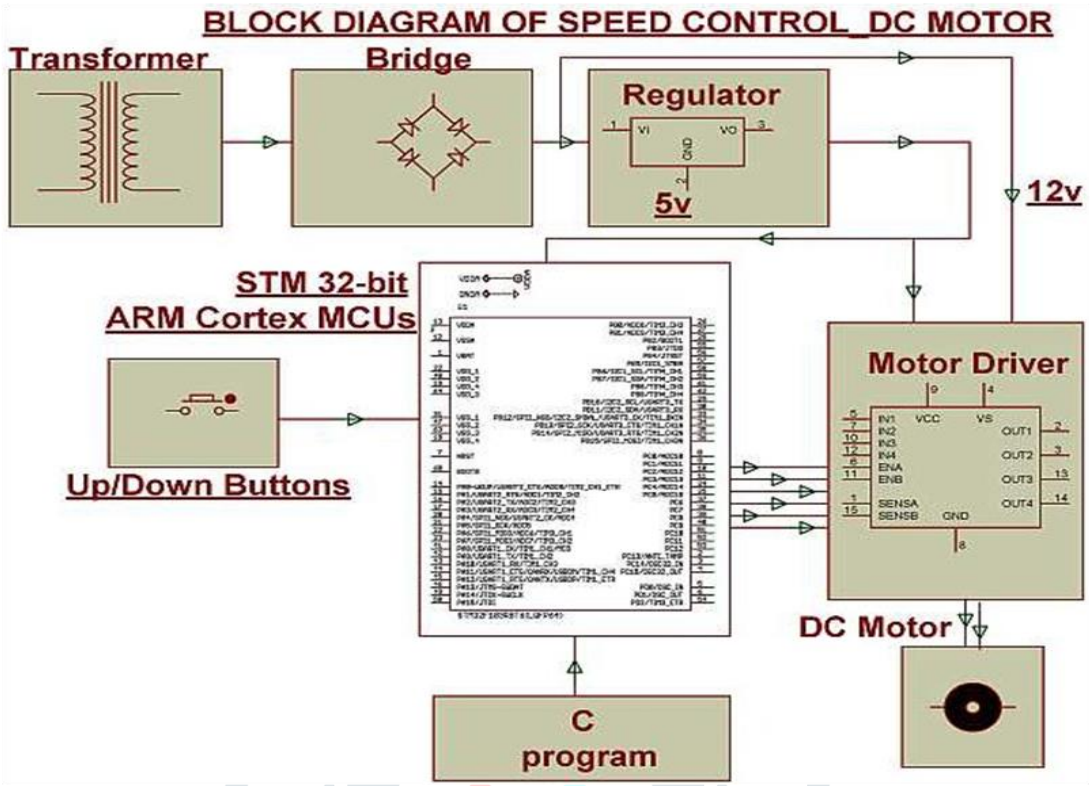

figure 1: block diagram of load controller

2.6 LCD Display: LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in a 5x7 pixel matrix.

2.7 Bluetooth Module HC-05: It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications. It has a range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency- hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with a microcontroller using a serial port (USART). Bluetooth Module Serial Interface: So, when we want to communicate through a smartphone with HC-05 Bluetooth module, connect this HC-05 module to the PC via serial to USB converter. Before establishing communication between two Bluetooth devices, 1st we need to pair the HC-05 module to a smartphone for communication. Pair HC-05 and smartphone: Search for a new Bluetooth device from your phone. You will find Bluetooth devices with "HC-05" name. Click on connect/pair device option; default pin for HC-05 is 1234 or 0000.

2.8 Processor: An ARM processor is one of a family of CPUs based on the RISC (reduced instruction set computer) architecture developed by Advanced RISC Machines (ARM). ARM makes 32-bit and 64-bit RISC multi-core processors. RISC processors are designed to perform a smaller number of types of computer instructions so that they can operate at a higher speed, performing more millions of instructions per second (MIPS). By stripping out unneeded instructions and optimizing pathways, RISC processors provide outstanding performance at a fraction of the power demand of CISC (complex instruction set computing) devices. ARM processors are extensively used in consumer electronic devices such as smartphones, tablets, multimedia players and other mobile devices, such as wearables. Because of their reduced instruction set, they require fewer transistors, which enables a smaller die size for the integrated circuitry (IC).

3. RESULT:

In our project we control the various loads such as bulb, motor, fan using ARM sensor Arduino board, mobile phone and Bluetooth model. In the present power system for load management the end user helps to minimize peak demands on the utility infrastructure as well as better utilization of power plant capacity. In this project we used ARM CORTEX. The load

demand at every instant first calculated and then compared with the permissible maximum load value, and when the instantaneous maximum demand value is inferior than the permission limit then the operation to be considered in equilibrium state, but when the of instantaneous value of maximum demand crosses the limits of controller, ARM CORTEX comes into the picture and control the load by the phenomena of load shedding based on the priority set by the user. Multiple Demands controller is a device designed to control and meet the need of power management in industry in a conscious manner although devices are on standby mode consume power so in this case if corrective action is not taken the controller switches off non-essential loads in a logical sequence. This is one of the innovative methods to control loads using android mobile. By using this method we can control any of the loads in industry located in various locations from a control room at a time. This method is very secure. Authenticated persons can only control the loads. We can control the appliances from anywhere using mobile phones.

4. CONCLUSION:

This is one of the innovative methods to control loads using android mobile. By using this method we can control any of the loads in industry located in various locations from a control room at a time. This method is very secure. Authenticated persons can only control the loads. We can control appliances from anywhere using mobile phones. In this project we should not connect AC loads directly to the microcontroller since AC may enter into the controller due to this our controller may be destroyed. To avoid such a type of drawback we need some drivers. In this project we are using a relay as a load controller (as a switch). Motors have a large scale use in industries for automation purposes.

5. REFERENCES:

- https://www.bing.com/search?q=multiple+load+controller+using+ARM+controller+&go=Se arch&q s=ds&form=QBRE
- https://nevonprojects.com/multiple-loadcontroller-for-industry-using-arm-cortex
- https://www.marshbellofram.com/.../products/a rm-series-integrated-duplex-controller
- https://literature.rockwellautomation.com/idc/groups/literature/documents/at/1756-at...
- https://binaryupdates.com/adc-in-lpc2148-arm7-microcontroller
  https://www.physicsforums.com/threads/howcan-i-control-two-outputs-with-a-single-pid...
  https://electronics.stackexchange.com/questions/3196/how-to-configure-an-arm-gpio-port...
  https://www.ijser.org/researchpaper/WirelessRobotic-Hand-Using-Flex-Sensors.pdf
- Protoger C, Pearce S. Laboratory evaluation and system sizing charts for a second generation direct PV -powered, low cost submersible solar pump. Sol Energy 2000;68:453–74.
- Abouda S, Nollet F, Chaari A, Essounbouli N, Koubaa Y. Direct torque control – DTC of induction motor used for piloting a centrifugal pump supplied by a photovoltaic generator. Int J Electr Robot Electron Commun Eng 2013; 7 (8):619–24.