Multiple Load Controller for Industry using ARM Cortex

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Abstract - *Motors have a large scale use in industries for automation purposes. In many cases such as bottling lines, packing machinery line, packing line and other automation lines, motor synchronization is very important in order to get fast and desired output from the automation line. One synchronization error can damage the manufacturing process. Here we demonstrate a multiple motor synchronization system that synchronizes the movement of multiple motors to demonstrate the concept. Our system uses ARM cortex to control motors with synchronized movement as well as speed for batch automation processes to work smoothly. We use PWM signals to operate motors at desired speeds and the ARM processor constantly supplies PWM while maintaining synchronization between motors to achieve desired process synchronization.*

Keywords: large scale industry, multiple motor, ARM cortex.

1. INTRODUCTION

This paper presents a design and prototype implementation of new industrial automation system that uses android technology as a network infrastructure connecting its parts. The proposed system is better from the scalability and flexibility point of view than the commercially available industrial automation systems. In Industry we have different types of loads at different locations. We can control all loads at a same time from one place (control room) without connecting any physical wire between loads and control room, in this project we are using Bluetooth module, relay. In this project app is being used by phone and the loads are operated with it. In this project we should not connect AC loads directly to microcontroller since AC may enter into controller due to this our controller may be destroyed. To avoid such type of drawback we need some drivers. In this project we are using relay as load controller (as a switch). Motors have a large scale use in industries for automation purposes. In many cases such as bottling lines, packing machinery line, packing line and other automation lines, motor synchronization is very important in order to get fast and desired output from the automation line. One synchronization error can damage the manufacturing process. Here we demonstrate a multiple motor synchronization system that synchronizes the movement of multiple motors to demonstrate the concept. Our system uses ARM to control motors with synchronized movement as well as speed for batch automation processes to work smoothly. We use n. PWM signals to

operate motors at desired speeds and the ARM processor constantly supplies PWM while maintaining synchronization between motors to achieve desired process synchronization.
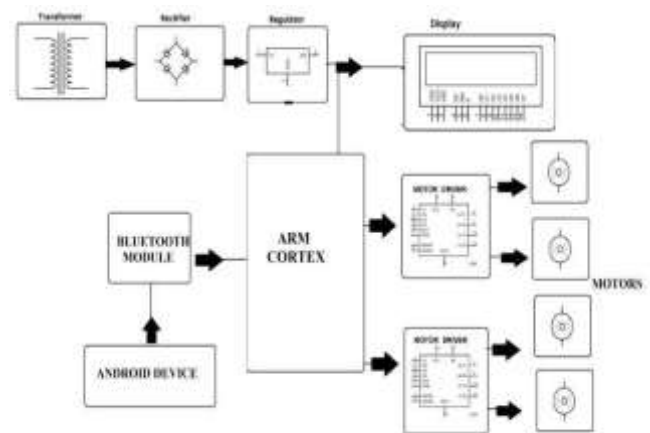
2. SYSTEM DESIGN AND DETAILS

Fig. 1. Block diagram multiple load controller

LCD DISPLAY:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is 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 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.
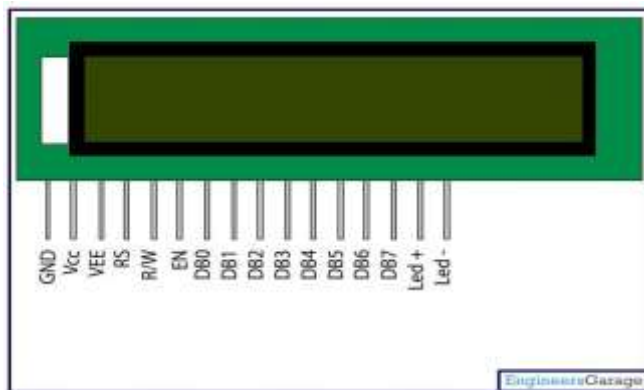
Fig.2. 16*2 LCD Display.

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 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 microcontroller using serial port (USART).

Fig3. HC-05 Bluetooth Module

Bluetooth Module Serial Interface:

So, when we want to communicate through 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 HC-05 module to smartphone for communication.

Pair HC-05 and smartphone:

Search for new Bluetooth device from your phone. You will find Bluetooth device with "HC-05" name.

Click on connect/pair device option; default pin for HC-05 is 1234 or 0000.
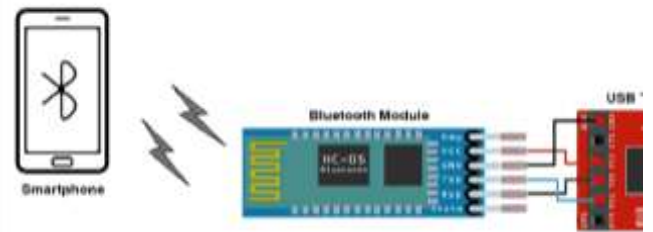
MICRO BUZZER 5V DC / 20mA PCB TYPE:

Features:

- Sealed yes operating power 3.6 volt DC/25Ma
- Extremely compact ultrathin construction
- No electrical noise
- low current consumption
- High sound pressure level.

2.1 ARM 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 wearable's. Because of their reduced instruction set, they require fewer transistors, which enables a smaller die size for the integrated circuitry (IC). The ARM processor's smaller size, reduced complexity and lower power consumption makes them suitable for increasingly miniaturized devices.

Fig: ARM processor

ARM processor features include:

- Load/store architecture.
- An orthogonal instruction set.
- Mostly single-cycle execution.
- Enhanced power-saving design.
- 64 and 32-bit execution states for scalable high performance.
- Hardware virtualization support.

The simplified design of ARM processors enables more efficient multi-core processing and easier coding for developers. While they don't have the same raw compute throughput as the products of x86 market leader Intel, ARM processors sometimes exceed the performance of Intel processors for applications that exist on both architectures.

The head-to-head competition between the vendors is increasing as ARM is finding its way into full size notebooks. Microsoft, for example, offers ARM-based versions of Surface computers. The cleaner code base of Windows RT versus x86 versions may be also partially responsible -- Windows RT is more streamlined because it doesn't have to support a number of legacy hardware.
ARM is also moving into the server market, a move that represents a large change in direction and a hedging of bets on performance-per-watt over raw compute power. AMD offers 8-core versions of ARM processors for its Opteron series of processors. ARM servers represent an important shift in server-based computing. A traditional x86-class server with 12, 16, 24 or more cores increases performance by scaling up the speed and sophistication of each processor, using brute force speed and power to handle demanding computing workloads.

2,2 Hardware Specifications:

- Transformer
- Rectifier
- Regulator
- LCD
- Bluetooth Module
- Motors

- Motor Driver
- ARM LPC 2148
- Android Device
- Resistors
- Capacitors
- Diodes

Software Specification:

- Programming Language
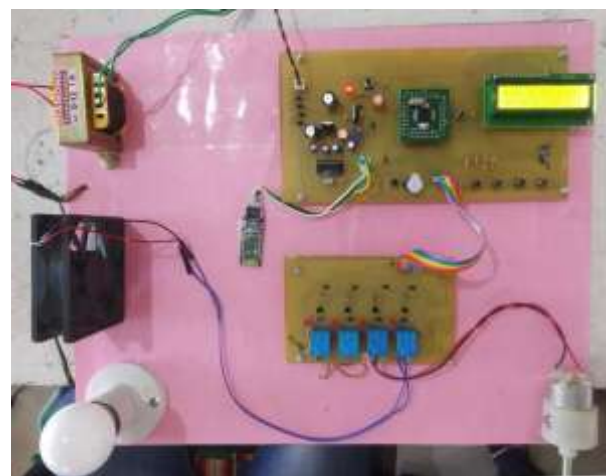- ARDUINO IDE

3. RESULTS

Fig: Multiple load controller using ARM cortex

In our project we control the various load 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 of user help 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 design to control and meet the need of power management in industry in a conscious manner although device are on standby mode consume power so in this case if corrective action is not taken the controller switches of non-essential loads in a logical sequence.

4. CONCLUSIONS

This is one of the innovative Method 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 very secured. Authenticated persons can only control the loads. We can control the appliances from anywhere using mobile phone. In this project we should not connect AC loads directly to microcontroller since AC may enter into controller due to this our controller may be destroyed. To avoid such type of drawback we need some drivers. In this project we are using relay as load controller (as a switch). Motors have a large scale use in industries for automation purposes.

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