Automated bulk IC programming unit for manufacturing industries

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Abstract: The automated bulk IC programming unit is aimed at companies manufacturing electronic devices. This can be used to program hundreds of ICs without any intervention and also no supervision is required. The IC just needs to be placed on the conveyer after which all the functioning is handled by the electro-mechanical system. This reduces human effort to a greater extent by using scientific technology. PICkit is a family of programmers for PIC microcontrollers. They are used to program and debug microcontrollers as well as program EEPROM. Thus the set up can be employed to debug programs with varying memory into the programmable ICs.

Keywords: Arduino kit, DC motor, Infrared sensor, PICkit, servo motor, ZIF socket.

I.   Introduction

Electronic devices in the market have made human life so simple and luxurious. Manufacturing these devices involves programming the ICs which is the heart of the system. Programming ICs in industries is a part and parcel of their daily routine. It is also needed to protect the code from falling into wrong hands. Programming an IC in industry of electronics is very common. The programming of the ICs are very time consuming and to program an IC, a programmer has to manually put the IC which is to be programmed in to ZIF socket and the programmer should be present at that place only to check whether the IC is programmed or not. If the same program has to be dumped to hundreds of ICs it consumes so much of time of the programmer. Thus people tend to waste most of their time by making the process fully manual or semi-automatic. The present day programming approach is inefficient in a way of wasting valuable man power [1].

The aim of this paper "DESIGN AND IMPLEMENTATION OF AUTOMATED BULK IC PROGRAMMING UNIT" is to overcome these problems with the introduction of automated approach. In this system the blank ICs to be programmed are sent on to the conveyer one by one. IC is stopped by a stopper so as to place it in a proper position. IC is detected by the IR sensor and a signal is sent to ARDUINO which in turn sends the signal to the motor to push the IC into the socket. ZIF socket is locked by the next motor. Then a signal is sent to the ARDUINO to program the IC. The code that is programmed into the IC is saved in the programmer itself. Once the programming is done a red LED glows in the ARDUINO KIT. Then the stopper moves up and the IC moves forward. This prevents the code from being copied by any intruder. Thus IP is maintained.

The designing and implementation of automated bulk IC programming unit is aimed at companies manufacturing electronic devices. This can be used to program hundreds of ICs with the same program without intervention and also no supervision is required. The IC only needs to be placed on the conveyer after which all the functioning is handled by the electro mechanical system. Also the Arduino hardware platform already has the power and reset circuitry setup as well as circuitry to program and communicate with the microcontroller over USB. The set up can be employed to debug programs with varying memory into the programmable ICs. Thus it reduces human effort to a greater extent by using scientific methodology [2].

II. Problem Definition

The present day programming approach is inefficient in the way of wasting valuable man power. The solution for the above can reduce the human effort to a great extent. If the same program has to be dumped into a number of ICs, a programmer has to manually put each one of the ICs into a programmer socket and waits until the IC is programmed and again put another IC and wait until it gets programmed and so on. This method does not waste valuable man power.

III. Literature Survey

In recent years, the power quality of the AC system has become a great concern due to the rapid increase in the numbers of electronic equipments, power electronics and high voltage power system. In order to reduce harmonic contamination in power lines and improve transmission efficiency, power factor correction research became a hot topic. Many control methods for the power factor correction (PFC) were proposed. This paper describes the design and development of a three-phase power factor corrector using PIC (programmable interface circuit) micro-controlling chip. This involves sensing and measuring the power factor value from the load using PIC and sensors, then using proper algorithm to determine and trigger sufficient switching capacitors in order to compensate excessive reactive components, thus withdrawing PF near to unity; as a result acquires higher efficiency and better quality AC output. Various power factor correction methods will also be discussed upon their applications in specific sections [3].

PIC 16F72 Microcontroller Operated Stepper Motor speed control is one of the most versatile forms of generating control by adjusting coal feeding rate. This system tries to improve the efficiency of CHP and also reliability of the system. It adjusts the feed rate through controlling speed of the Motor of the Conveyor Belt of feeding coal to Crusher of the system considering the demand of energy in peak & lean hours. If any abnormality occurs, this system has interlocks to tripped the motors and avoid the damages of the system. The main motto of this system is to control the generation of energy depending on the requirement load demand of the system. To develop the scheme of automatic generation control, variation of coal feeding rate to Coal Handling Plant in made automatic depending on the load demand. Safety interlocks in between the Motors employed in the CHP are also developed. To make the process automatic, a Stepper Motor is used in the Power System controlled by Microcontroller. So, the system becomes more flexible due to use of the Microcontroller as the coal feeding rate can be customized as per the requirements of the system [4].

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A low-profile micro strip patch antenna has been designed for tuning on a discrete set of instant frequencies. The frequency configurability is obtained by resorting to electrically actuated switches operated via a software-controlled biasing network. A low-cost PIC microcontroller is employed to control the antenna operative condition among the available states. Measurements on a fabricated prototype show a good matching with simulations and prove the reliability of the proposed configuration [6][7].

IV. System Design

Figure 1 shows the block diagram of the programming unit. The main components are explained below.A gear motor is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications, and are probably used in many devices in your home. Gear motors are commonly used in devices such as can openers, garage door openers, washing machine time control knobs and even electric alarm clocks. Common commercial applications of a gear motor include hospital beds, commercial jacks, cranes and many other applications that are too many to list.Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here. A geared DC Motor has a gear assembly attached to the motor.The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed.Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure.This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.
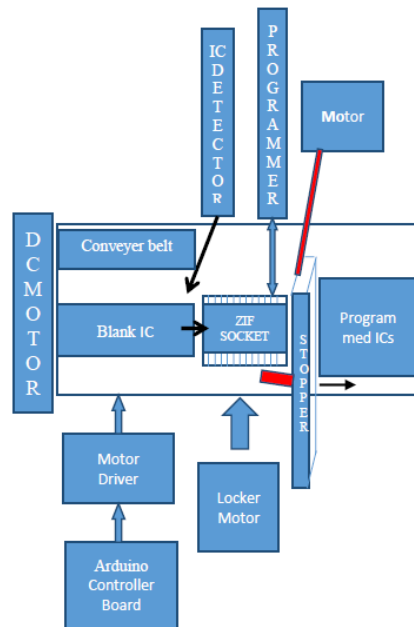
Fig.1 Block diagram of Automated IC Programming unit

The lateral view of the motor shows the outer protrudes of the gear head. A nut is placed near the shaft which helps in mounting the motor to the other parts of the assembly.The gear assembly is set up on two metallic cylinders whose working can be called as similar to that of an axle. A total of three gears combine on these two cylinders to form the bottom gear assembly out of which two gears share the same axle while one gear comes in between them and takes a separate axle.The gears are basically in form of a small sprocket but since they are not connected by a chain, they can be termed as duplex gears in terms of a second cog arrangement coaxially over the base. Among the three gears, two are exactly same while the third one is bigger in terms of the number of teeth at the upper layer of the duplex gear. The third gear is connected to the gear at the upper portion of the gear head. A gear motor can be either an AC (alternating current) or a DC (direct current) electric motor. Most gear motors have an output of between about 1,200 to 3,600 revolutions per minute (RPMs). These types of motors also have two different speed specifications: normal speed and the stall-speed torque specifications. Gear motors are primarily used to reduce speed in a series of gears, which in turn creates more torque. This is accomplished by an integrated series of gears or a gear box being attached to the main motor rotor and shaft via a second reduction shaft. The second shaft is then connected to the series of gears or gearbox to create what is known as a series of reduction gears. Generally speaking, the longer the train of reduction gears, the lower the output of the end, or final, gear will be [8].

An excellent example of this principle would be an electric time clock (the type that uses hour, minute and second hands). The synchronous AC motor that is used to power the time clock will usually spin the rotor at around 1500 revolutions per minute. However, a series of reduction gears is used to slow the movement of the hands on the clock.For example, while the rotor spins at about 1500 revolutions per minute, the reduction gears allow the final secondhand gear to spin at only one revolution per minute. This is what allows the secondhand to make one complete revolution per minute on the face of the clock.In any DC motor, RPM and torque are inversely proportional. Hence the gear having more torque will provide a lesser RPM and converse. In a geared DC motor, the concept of pulse width modulation is applied. In a geared DC motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part. The small duplex part receives the torque but not the speed from its predecessor which it transfers to larger part of other gear and so on. The third gear's duplex part has more teeth than others and hence it transfers more torque to the gear that is connected to the shaft.

The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. After the invention of computers they were also used to perform Boolean and

other logical operations. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors. The basics for all the relays are the same [9].

A Servo motor is revolving or linear motion actuator, that allows the precisely control of its linear velocity, acceleration or angular position. It consists of a suitable motor coupled sensor for feedback control. This motor is control with sophisticated controller or a special kind of module is designed for controlling this motion. The servo motor use PWM signal for controlling the DC motor; unlike normal PWM usually used in ordinary DC motor; this PWM signal is not use for controlling the rotation speed, instead it is use for controlling the motor direction or position. Most servo motor will work well on 50 Hz of PWM frequency; this mean the PWM signal should have a period of 20ms. The electronic circuit inside the servo motor will response to the PWM signal width; the 0.7ms to 1ms PWM width will make the servo motor to turn clockwise (CW), the 1.7ms to 2ms PWM width will make the servo motor to turn counterclockwise (CCW). For the standard servo the 1.5ms PWM width will turn the servo motor to its center.A servo motor is basically a DC motor (in some special cases it is AC motor) along with some other special purpose components that make a DC motor a servo. In a servo unit, you will find a small DC motor, a potentiometer, gear arrangement and an intelligent circuitry. The intelligent circuitry along with the potentiometer makes the servo to rotate according to our wishes. As we know, a small DC motor will rotate with high speed but the torque generated by its rotation will not be enough to move even a light load. This is where the gear system inside a servomechanism comes into the picture. The gear mechanism will take high input speed of the motor (fast) and at the output, we will get an output speed which is slower than original input speed but more practical and widely applicable.Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. This output port of the potentiometer is connected with one of the input terminals of the error detector amplifier. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from external source, will be amplified in the error detector amplifier and feeds the DC motor. This amplified error signal acts as the input power of the DC motor and the motor starts rotating in desired direction. As the motor shaft progresses the potentiometer knob also rotates as it is coupled with motor shaft with help of gear arrangement. As the position of the potentiometer knob changes there will be an electrical signal produced at the potentiometer port. As the angular position of the potentiometer knob progresses the output or feedback signal increases. After desired angular position of motor shaft the potentiometer knob is reaches at such position the electrical signal generated in the potentiometer becomes same as of external electrical signal given to amplifier. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer. As the input signal to the motor is nil at that position, the motor stops rotating. This is how a simple conceptual servo motor works [10].

The PICkit 3 programmer/debugger is an integral part of the development engineer's tool suite. The application usage can vary from software development to hardware integration.The PICkit 3 programmer/debugger is a debugger system used for hardware and software development of Microchip PIC® microcontrollers (MCUs) and dsPIC® Digital Signal Controllers (DSCs) that are based on In-Circuit Serial Programming™ (ICSP™) and Enhanced In-Circuit Serial Programming 2-wire serial interfaces. In addition to debugger functions, the PICkit 3 programmer/debugger system also may be used as a development programmer.The debugger system executes code like an actual device because it uses a device with built-in emulation circuitry, instead of a special debugger chip, for emulation. All available features of a given device are accessible interactively, and can be set and modified by the MPLAB IDE interface. Figure 2 shows the PICkit 3 debugger was developed for emulating embedded processors with debugfacilities.

A convenient lanyard connection is available on the programmer.The USB port connection is a USB mini-B connector. Connect the PICkit 3 to the PC usingthe supplied USB cable.This marker designates the location of pin 1 for proper connector alignment.The programming connector is a 6-pin header (0.100" spacing) that connects to the target device.The components of the PICkit 3 programmer/debugger system are:
1. PICkit 3 with indicator lights for power, activity and status.
2. USB cable to provide communications between the debugger and a PC and to provide power to the debugger.
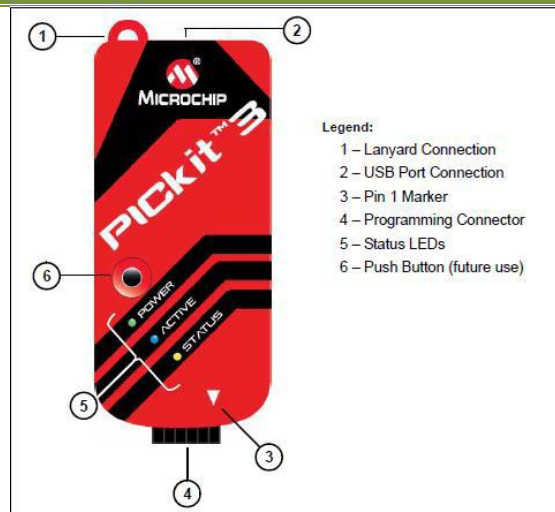3. CD-ROM with MPLAB IDE software and on-line documentation.

Figure 2 PICkit3 MCU PROGRAMMER/DEBUGGER

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Show in fig 4 Read more about IR sensors [11].

Arduino Uno Rev. 3 Microcontroller Board is based on the Atmel ATmega328 8-bit Microcontroller (MCU). Arduino Uno features 14 digital input/output pins (six of which can be used as PWM outputs), six analog inputs, and a 16MHz quartz crystal. Uno also includes a USB connection, a power jack, an In-Circuit Serial Programming (ICSP) header, and a reset button. This Arduino MCU board contains everything the user needs to support the MCU. The user can get started by connecting the Uno to a computer with a USB cable or by powering it with an AC-to-DC adapter or battery. The Uno can be programmed with Arduino Software (Integrated Development Environment). The ATmega328 on the Uno comes preprogrammed with a boot loader that allows the user to upload new code to the MCU without the use of an external hardware programmer. Arduino Uno differs from preceding boards in that it does not use the FTDI USB-to-serial driver chip. This board instead features the Atmega16U2 programmed as a USB-to-serial converter.

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus [12].

V. System Implementation

PIC Microcontroller is the heart of the system. It controls the relay driving circuits which in turn controls the movement of the motors. For programming the device we use a standard readily available PIC Programmer. PIC Programmer is called the PICKIT and contains the hex file of the program to be dumped into the ICs. PIC Board contains the supporting circuitry for PIC 16F877A IC operation. It is the heart of the project and controls the movement of motors through relays. This is a device from Microchip that holds the hex file of

the program to be dumped into the blank ICs. If the programming is successful, a green LED glows else, a red LED glows if failed. ICs need to be fixed in the ZIF socket to program it. This will have necessary connections with the programmer. Mechanical Setup consists of relays and gear motors which work in synchronism. The relays receive the signal from the PIC in order to control the movement of motors in specified direction. The ICs which is to be programmed is made to move on conveyer one by one and are detected by the IC DETECTOR. The IC will be automatically closed by the stopper and the PIC programmer programs the ICs. The IC to be programmed is sent on conveyer, conveyer in turn connected to the conveyer motor which will be rotating at a certain speed and thus brings the blank IC to be programmed to the ZIF socket.

VI. Conclusion

The unit is aimed at programming ICs in bulk. From the experimental results it can be concluded that the ICs have been detected followed by which they have been programmed successfully using PICkit through arduino which controls the entire system operation. The set up can thus be used universally for any number of ICs without human intervention reducing efforts to a great extent. The IC needs to be placed onto the belt and the electro-mechanical system carries out the entire process. This can efficiently be employed in IC manufacturing units.

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