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Time Optimization and Enhancing Production in the Manufacturing Industry

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ABSTRACT: CNC are an industrial machine used in many branches of industries. CNC's had made revolutionary changes within the manufacturing sector in achieving productivity up to desired level was not possibilities due to the lot of drawbacks like lack of labors, improper time scheduling. To overcome this problem, TOMI [Time Optimization in Manufacturing Industry] has been used which makes the machines to be work in proper timing and it also enhancing the productivity.Microcontroller and relay module are connected with RS232 works on the two-way communication that exchanges data to one another. (DTE) Data Transmission Equipment& (DCE) Data Communication Equipment which has the pins like TXD, RXD, and RTS& CTS.The output like DC motor ON/OFF status and counter values are shown in LCD Display. We used Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all-device working is based on microcontroller that are programmed by embedded C. This is our solution implement in the manufacturing industries to optimize in the scheduledtime.

KEYWORD: CNC, TOMI, Microcontroller, RS232, DTE, DCE, Manufacturing, Production,Time Scheduling, Embedded C.

1. INTRODUCTION

Increasing demand in global markets leads to high variety of products, reducing cost in manufacturing, lesser lead time and perfect quality. This makes manufacturing industries to adapt lean concepts. Lean philosophy is universal and can be applied to manufacturing, design, quality control, administration, order taking, accounts receivable or any activity that needs to be improved. Lean has been recognized as one of the key approaches in enhancing the productivity. Lean is nothing but manufacturing without waste, lean is centred on preserving value with less work "A systematic approach to identifying and eliminating waste called non-value added activities through continuous improvement by flow the product at the pull of the customer in pursuit of perfection. Lean manufacturing concepts also focusing on reduction of cost by eliminating the non-value-added activities (NVA) and reduction of necessary non value-added activities (NNVA). Value added activity means that physically changes the material and non-value-added activity means that takes time, space, material but does not changes the physical material. This paper focuses on work in CNC machine cell area, where the cell produces the gearbox housing unit. Already lean tools like 5S, continuous flow, just-in time; overall equipment effectiveness is implemented in this CNC manufacturing cell. The study focuses on work standardization by creating the standard operating procedures (SOP) with line balancing layout optimization. A brainstorming session was also carried out with the process engineers, team leader, cell brigadier and operators regarding the issues faced in the machining cell and identified the bottleneck area, which is essential to enhance the overall productivity to meet the customer demand at right time.

A. CNC Machine System:CNC machine operates on only two subjects which are CAD and CAM. CAD stands for Computer-aided design. This subject helps you to learn about the design of a machine and machines tools. CAM stands for Computer-aided manufacturing. This subject is also similar to CAD but it deals with manufacturing whereas CAD deals design. In this project, we use DC motor instead of CNC Machine to implement our idea.

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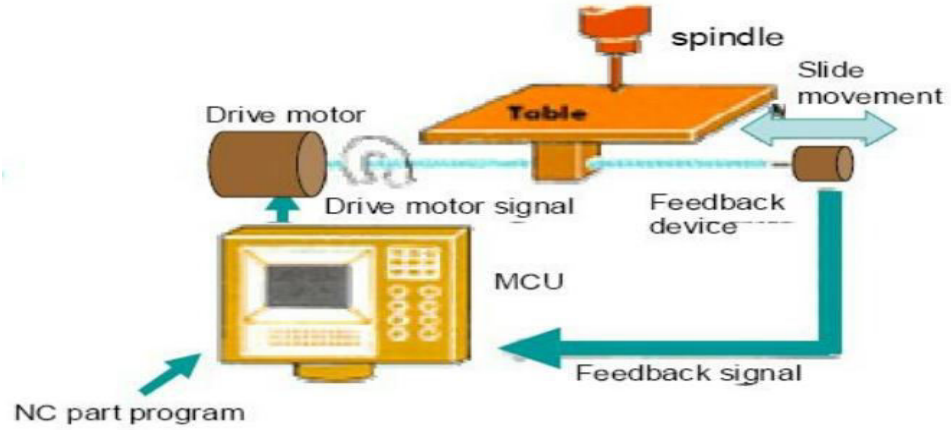

Fig A: CNC Process diagram

II. EXISTING SYSTEM

CNC are an industrial machine used in many branches of industries. CNC's had made revolutionary changes within the manufacturing sector in achieving productivity up to desired level was not possibilities due to the lot of drawbacks like lack of labors, improper time scheduling. To overcome this problem, TOMI [Time Optimization in Manufacturing Industry] has been used which makes the machines to be work in proper timing and it also enhancing the productivity.

III. PROPOSED SYSTEM

The proposal gives a simplified and efficient way to increase the production and trade level of the Industry and TOMI helps to control the CNC machine in an efficient way.

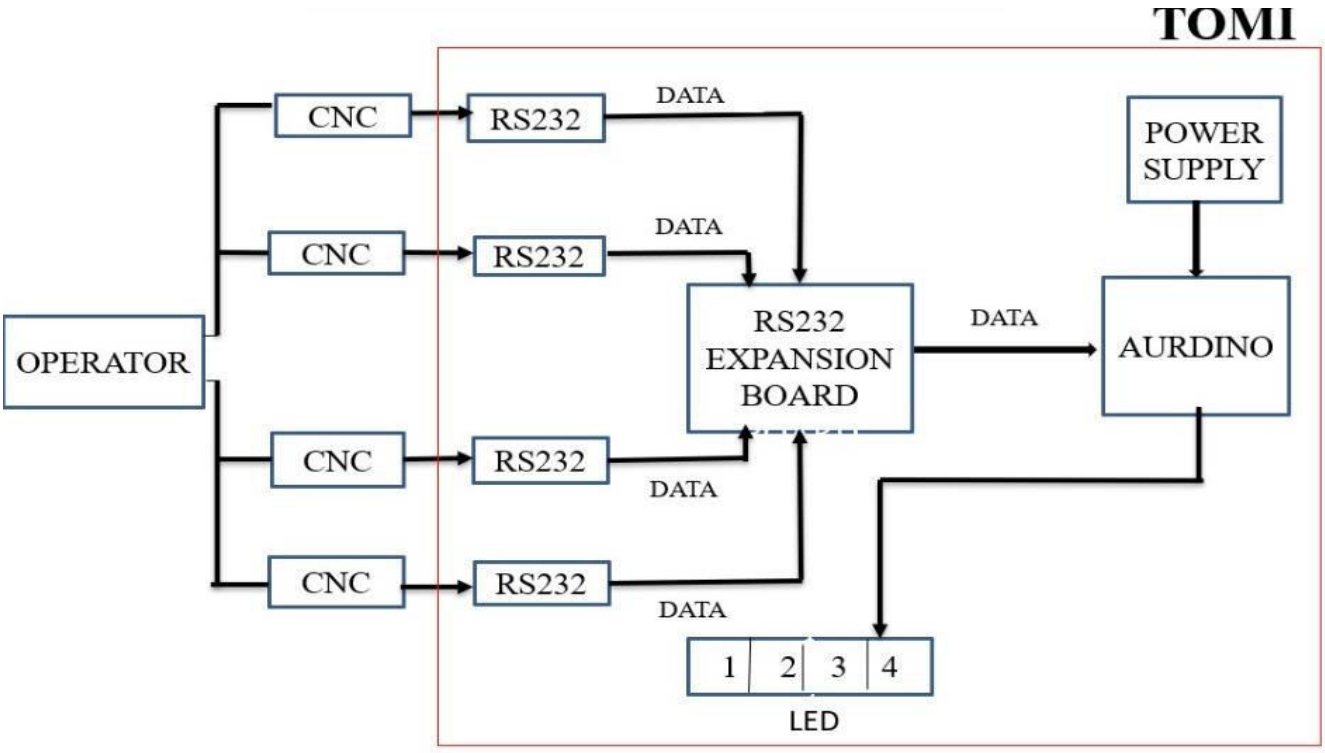

Fig 3.1 Proposed system block diagram

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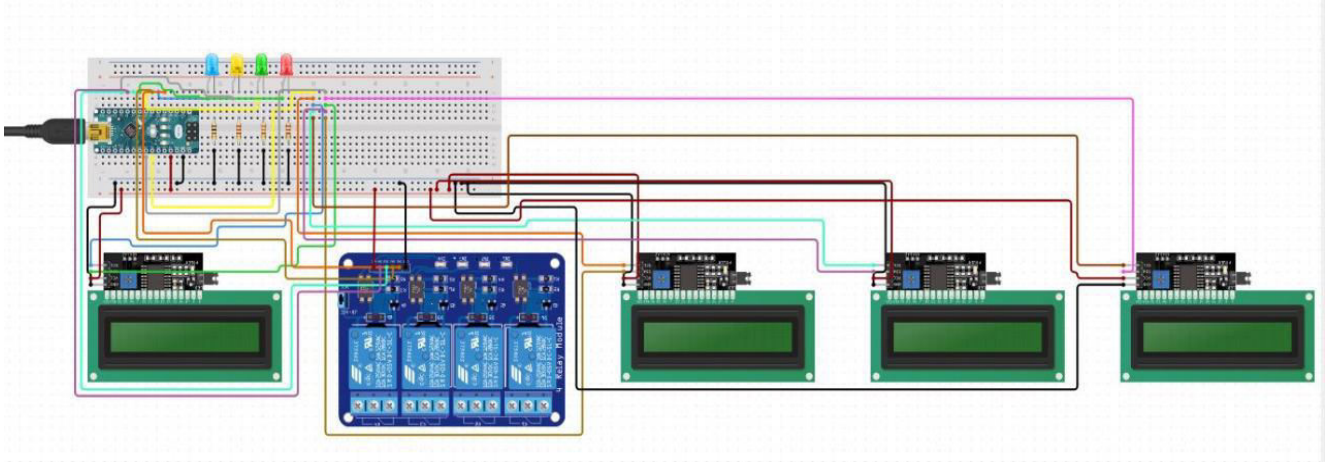

Fig 3.2 Proposed system circuit diagram

IV. HARDWARE REQUIREMENTS

1.1. ARDUINO NANO V3:

Arduino boards are widely used in robotics, embedded systems, and electronic projects where automation is an essential part of the system. These boards were introduced for the students and people who come with no technical background.Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x).It comes with exactly the same functionality as in Arduino UNO but quite in small size. It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.Arduino Nano Pin-out contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins. Each of these Digital & Analog Pins is assigned with multiple functions but their main function is to be configured as input or output. They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output. Functions like pinMode() and digitalWrite() are used to control the operations of digital pins while analogRead() is used to control analog pins. The analog pins come with a total resolution of 10bits which measure the value from zero to 5V.Arduino Nano comes with a crystal oscillator of frequency 16 Mhz. It is used to produce a clock of precise frequency using constant voltage. There is one limitation using Arduino Nano i.e. it doesn't come with DC power jack, means you cannot supply external power source through a battery.

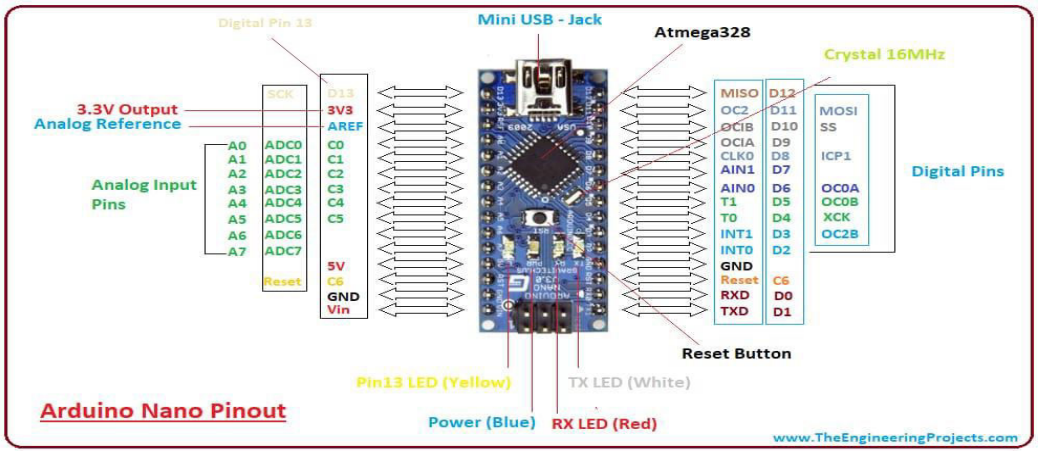

Fig 4.1 Arduino Nano V3 Diagram

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4.2. RELAY Module:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example, a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

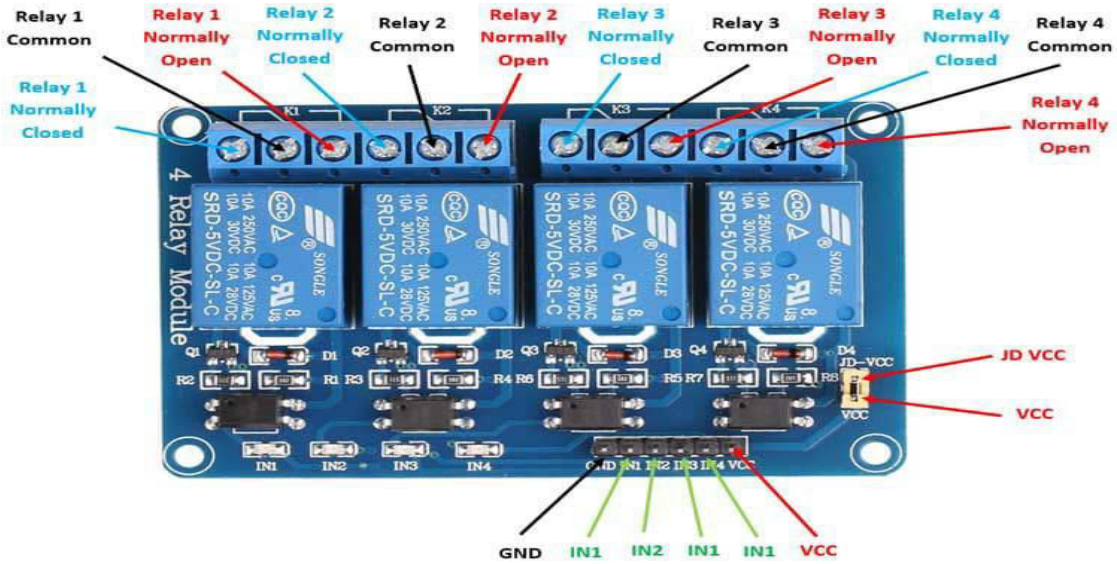

Fig 4.2. Relay Module

4.3.I2C LCD Backpack

You can use this with LCD modules that have a HD44780-compatible interface with various screen sizes. The key is that your LCD must have the interface pads in a single row of sixteen, so it matches the pins on the backpack. On Arduino Nano board, SDA (data line) is on analog pin 4, and SCL (clock line) is on analog pin 5. On the newer Arduino Nano ("R3" layout), the SCL and SDA pins are available as separate pins. If you are using a different board, ensure that you connect the SDA and SCL pins. Power the board with 5V.

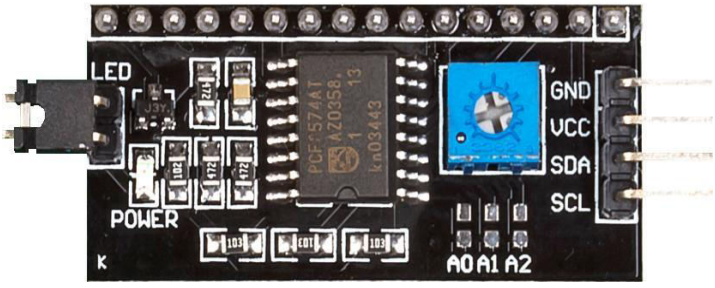

Fig. 4.3 I2C LCD Backpack

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4.4. 12 Volt Power Adapter:

It is 12 Volt 2A Power Adapter Supply AC to DC 2.1mm X 5.5mm Plug.This Power Supply is a Regulated Center Positive Power Supply Has a Compact Size & Light Weight, Regulated Stable Voltage. Good Quality SMPS Based Adapter Power LED Monitor (LED Glow When in Use) Stabilized Output, Low Ripple & Low Interference High Efficiency & Low Energy Consumption.

Fig .4.4 12V Power Adapter

4.5. RS232 EXPANSION BOARD:

One of the oldest, yet popular communication protocols that are used in industries and commercial products is the RS232 Communication Protocol. The term RS232 stands for "Recommended Standard 232" and it is a type of serial communication used for transmission of data normally in medium distances. It was introduced back in the 1960s and has found its way into many applications like computer printers, factory automation devices etc. Today there are many modern communication protocols like the RS485, SPI, I2C, CAN etc., You can check them out if interested. In this article, we will understand the basics of the RS232 Protocol and how it works.

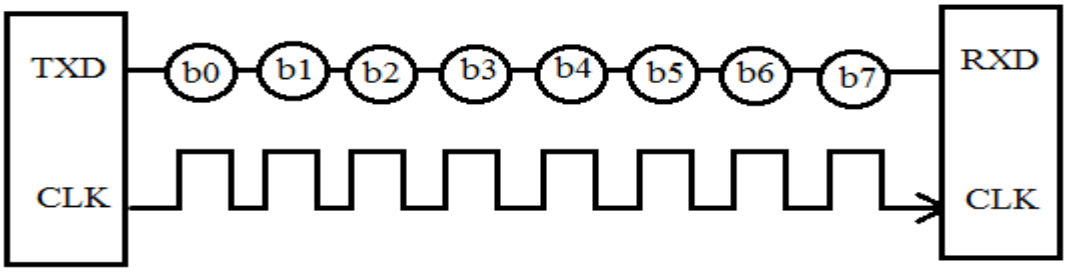

Fig 4.5 Serial communication Block diagram

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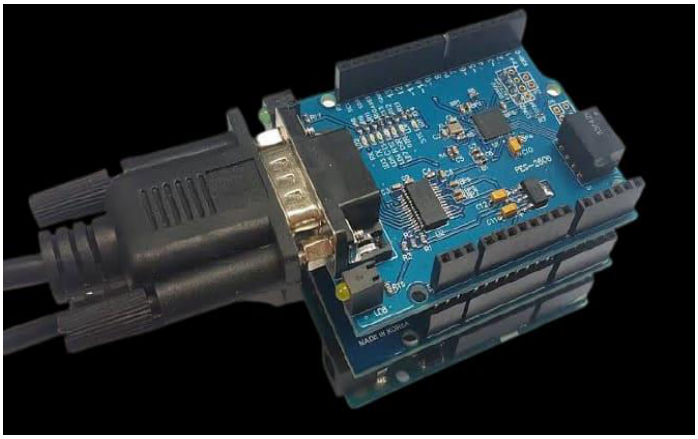

Fig. 4.5 RS232 EXPANSION BOARD

V. SOFTWARE REQUIREMENTS

5.1. ARDUINO IDE:

Programming the Arduino Nano can be programmed with the Arduino software (download). Select "Arduino Nano from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Nano comes pre-burned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See this user-contributed tutorial for more information. Automatic (Software) Reset Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer.

One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nano-farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

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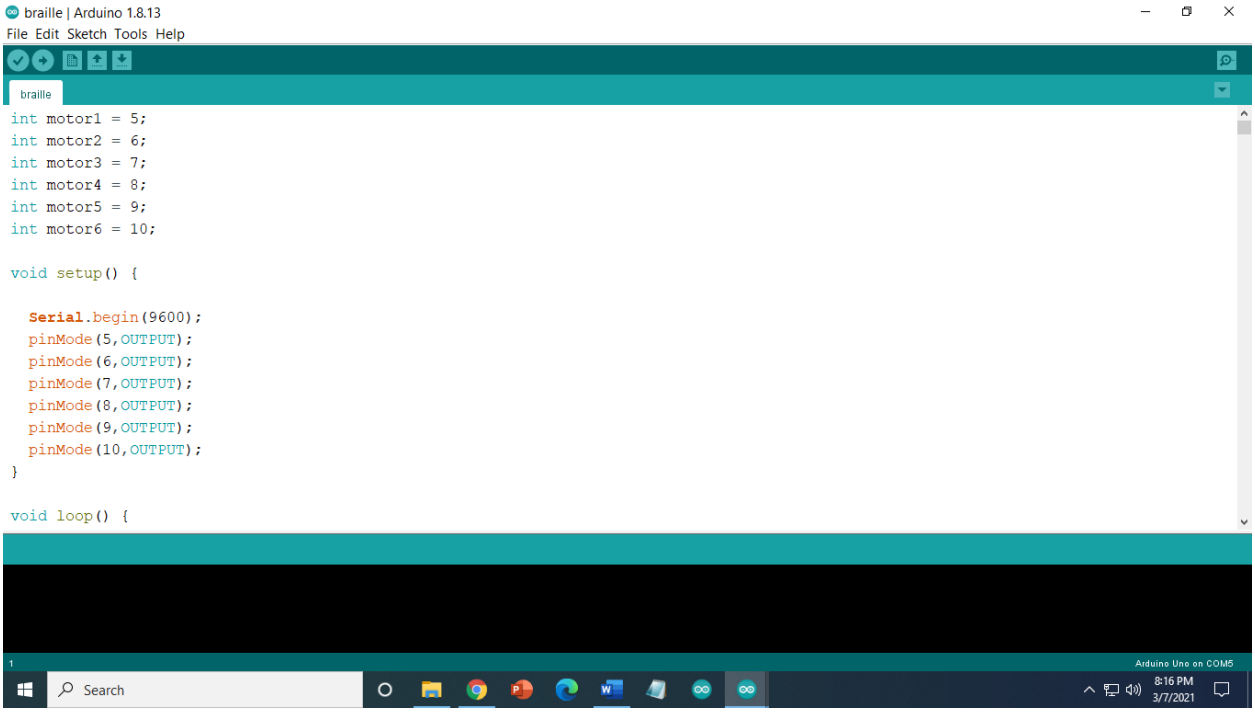

Fig 5.1 Arduino IDE Image

5.2. EMBEDDED C:

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software. Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all-device working is based on microcontroller that are programmed by embedded C. The Embedded C code written in above block diagram is used for blinking the LED connected with Port0 of microcontroller.In embedded system programming C code is preferred over other language. Due to the following reasons:

- Easy to understand
- High Reliability
- Portability
- Scalability

Function is a collection of statements that is used for performing a specific task and a collection of one or more functions is called a programming language.

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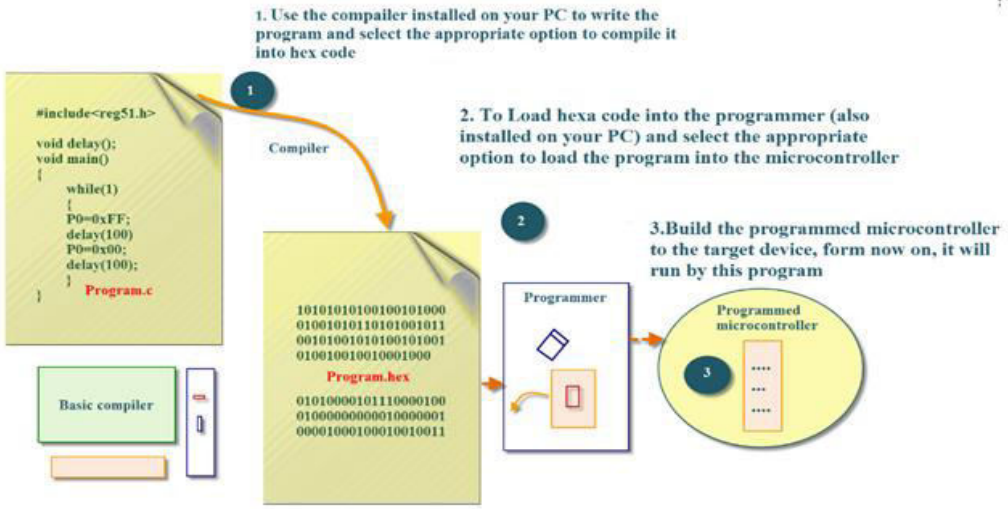

Fig 5.2 Embedded C block diagram

VIII. ALGORITHM

In this project, Time scheduling algorithm in order to maintain in a proper scheduled time.

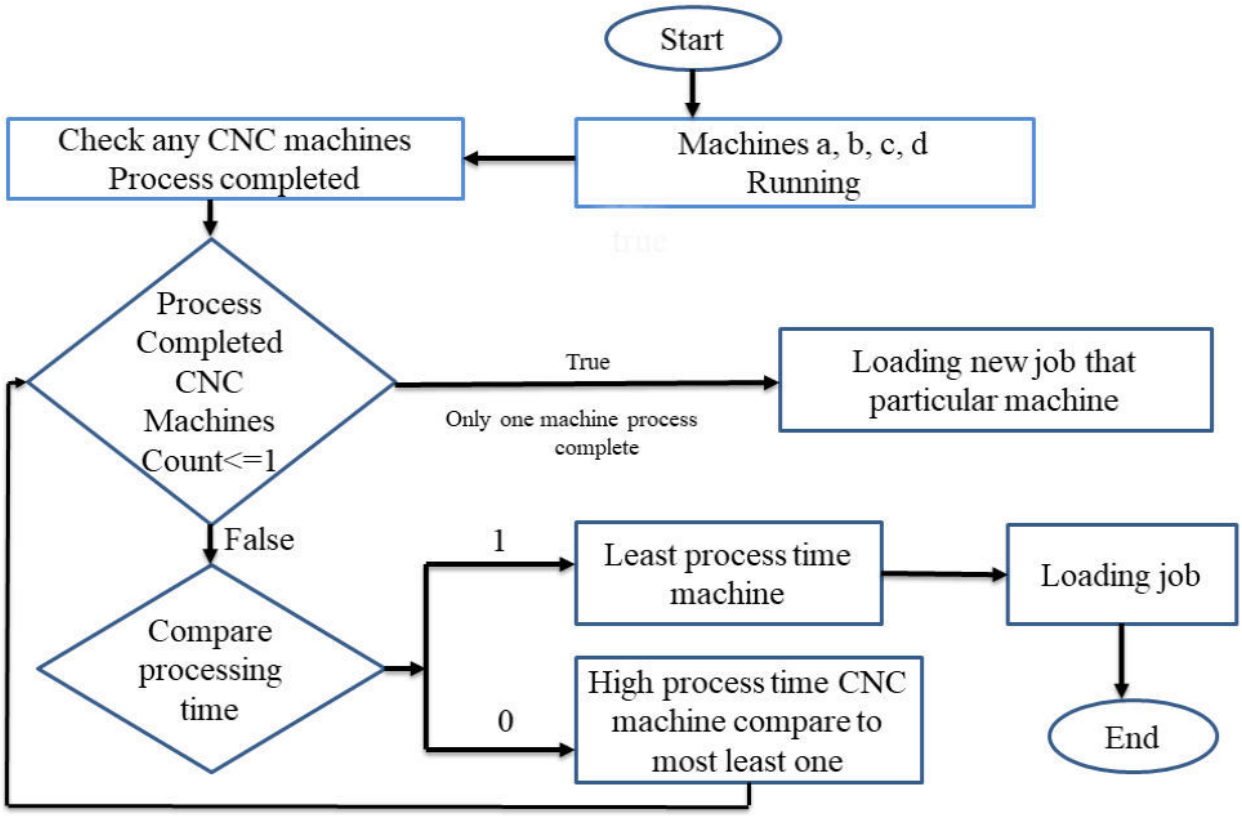

Fig 6.1 Flowchart

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IX. ADVANTAGES

- It helps in high production and avoids wastage of time.
- It saves energy manually for both man power and the machine.
- The accuracy of the output quantity is too good.
- It makes the more complicated and hard process into simple method.

X. RESULT AND CONCLUSION

A.Result

The result of this project is to control the timing of the CNC machine with help of Arduino Nano V3 ATmega328. In this project we program the proper scheduled time of the CNC machinewith help of hardware implementation given in the fig 8.1.

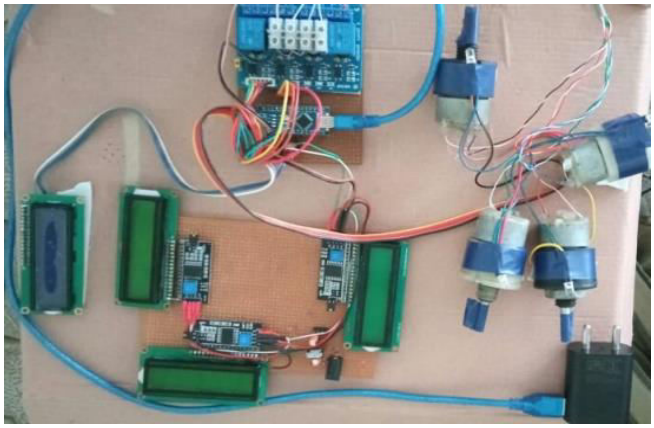

Fig 8.1 Hardware implementation of project

A. Conclusion

By studying this project along with the existing system, we can conclude that this project help as efficient way to increase the production and trade level of the Industry and TOMI helps to control the CNC machine therefore, we can reducing the labour confusion. As the existing systems, this process is not presented thereby we implementing this new technology to overcome the above problem. As we are using Arduino Nano which is reprogrammable with security and easy to use as compared to relay logic we can control multiple machines with multiple parameters with a single Arduino Nano V3.

XI. FUTURE SCOPE

TOMI [Time Optimization in Manufacturing Industry] is a device which has been used in the CNC machine.To avoid labour confusion and work them in a proper scheduled time in relaxed manner.It helps in enhancing the production and trade level of the Industry.If we commercial implement TOMI in future it may really help in machine production system to work in an efficient way.

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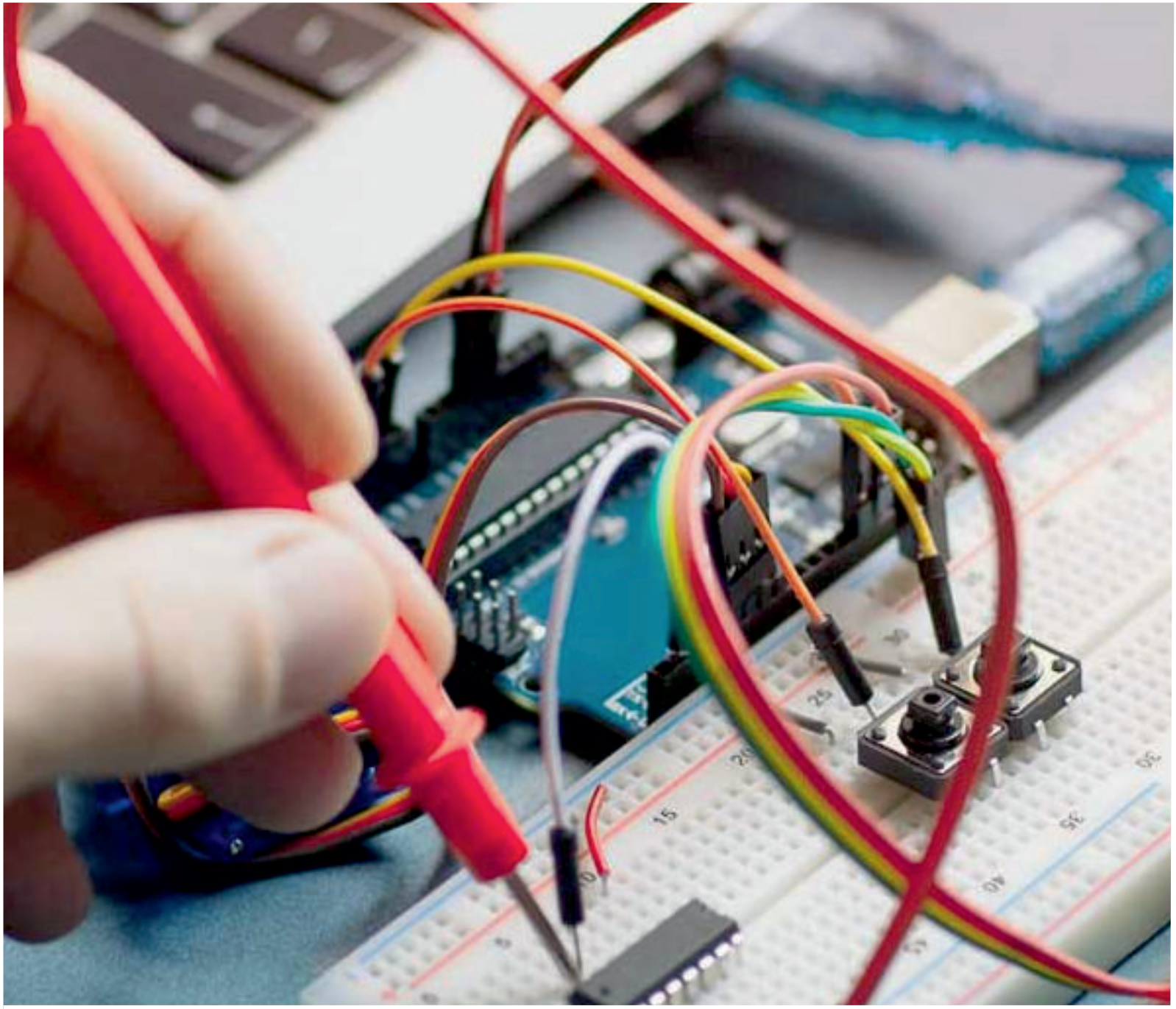

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