

INDUSTRIAL MACHINE CONTROL AND MONITORING SYSTEM USING IOT

¹Rajesh.G, ²RenukaGayathri.S, ³Parthipan .V ⁴Mizpah Jenny

^{1,2,3,4}Saveetha School Of Engineering, Thandalam, Chennai, Tamilnadu

¹rajesh.raj2609@gmail.com, ²renukagaya3@gmail.com

³parthipan.@saveetha.com, ⁴mizpahjenny@gmail.com

Abstract: Our objective is to design an Industrial machine control and monitoring system using IOT. Surveillance is most important security systems in home, industrial, office and public places. In this security system is based on the embedded system along with Microcontroller and sensor networks. The human movement is detected using the PIR sensors. In this time, the system triggers an alarm detecting the presence of person in a specific interval of time and simultaneously sends the how many persons are intruder. When the security system is activated, the PIR Sensor is activated. This highly reactive approach has low computational requirement. Therefore it is well suited for Industrial surveillance system. This surveillance security system implemented using Microcontroller and sensors. Industrial security systems have grown in popularity in recent years, a Industrial owner's look for ways to protect their personal space and enhance their Industrial values. It is necessary for every Industrial owner to considering adding a industrial security and monitoring system, as burglaries, thefts and murders have become routine in big cities. This paper demonstrates a Industrial machine control system that allows the user to control it with a wireless device such as a Wi-Fi or Bluetooth or Internet enabled mobile phone. A desktop PC is used to run the server software. The system allows the user to control each of the lights and fans individually. It can automatically turn off the main motors and turn on a motors at a specified time.

1. Introduction

Numerical management could be a methodology of mechanically in operation a producing machine supported a code of letters, numbers, and special characters. The numerical information needed to provide a district is provided to a machine within the kind of a program, referred to as half program or CNC program. The program is translated into the suitable electrical signals for input to motors that run the machine. Numerical management (NC) is the automation of machine tools that square measure operated by exactly programmed commands encoded on a storage medium, as critical controlled manually via hand wheels or levers,

or automatically machine-driven via cams alone. Most North Carolina nowadays is pc (or computerized) numerical management (CNC), during which computers play associate degree integral a part of the management.

2. Existing system

In processed Numerical management (industrial machines) systems the communication bus between the controller and axis servo drives should provide high information measure, noise immunity and time philosophical doctrine.

More and additional industrial machines systems use period of time local area network protocols like local area network Power Link (EPL). Many trendy controllers area unit closed pricey hardware-based solutions. during this article the implementation of EPL communication bus in a very PC-based industrial machines system is bestowed. The industrial machines system includes a computer pc, software system industrial machines controller running underneath UNIX Real Time Application Interface (RTAI) period of time software (RTOS) and servo-drives human action via EPL.

3. Proposed system

The thought of this project is to prove that, single board computers may monitor and management industrial machines. Instead of mistreatment pricey pcs (comparitively) we have a tendency to square measure about to management the commercial machine mistreatment this small embedded computer. This is attainable as a result of Arduino carries with it increased Quad Core Processor currently provides you with the chance to Broadcom BCM2836 Arm cortex-A7 Quad Core Processor supercharged Single Board pc running at 900MHz with 1GB RAM and peripherals of 40pin extended GPIO, 4 x USB two ports and carries with it four pole Stereo output and Composite video port with Full size HDMI.

It has CSI camera port for connecting the Arduino camera and DSI show port for connecting the Arduino bit screen show. Micro American state port for loading your software and storing information and small USB power

supply .The Arduino can replace manual programming with G code, that reduces the workforce consumption. We can use any electronic show device like movable, Tablet etc. It eliminates the usage of value on mistreatment computers, that is additional economical. Stepper Drivers that drives the stepper motors square measure directly connected to Arduino pins. The Input command on Arduino is given through show device to drive the motor. The system can be easily integrated into an existing electrical system of a building thanks to its simplified design. It can also be easily installed for just a single room if one so desires. Modifications to the existing electrical system are minimal, thereby reducing installations costs

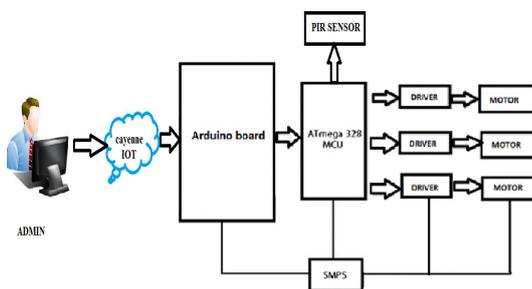


Figure 1. CNC Implementation

The mobile device connects to the server PC through Bluetooth or Wi-Fi or through the internet. The user sends commands to the server from the mobile device. The microcontroller is connected to the server via USB. On receiving commands from the mobile device, the server sends commands to the microcontroller over the USB connection. The microcontroller is directly connected to the relays and it can enable or disable them. The relays are connected to the electrical system of the building so that they can control the plug points.

4. System Implementation

4.1 Work Plan

4.1.1 Aim And Objective:

Our aim is To implement the Industrial machine by controlling Arduino using IOT .

Our objective is to design a Industrial machine control and monitoring system using IOT(Internet Of Things). In any modern structure safety has the highest priority and person detection system is one of the basic components of the structure. Timely information of person not only helps save lives but also makes it easier. To detect person as a soon as the possible.

4.2 Implementation:

This solution was implemented using Mozilla Firefox web browser from Mozilla foundation and also using Google Chrome from Google foundation. After entering into the Google chrome connect to the LAN cable to the Ethernet shield so that we can access the internet. On the other hand the arduino UNO is connected to the with the Ethernet shield so we can control our home appliances using iot. From the Battery, we can power supply so that we can control our Buzzer, CPU Fan, Led light. The process will be begin only when the PIR sensor finishes the work by indentify the customer who is that after that only the process will starts. The PIR sensor used only for indentifies the person. the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them. surveillance systems are habitually used in home, office, factory or vehicle monitoring and image identification.

4.3 Applications

- More operations can be performed with each setup, and less lead time for setup and machining is required compared to conventional methods.
- Machine adjustments are easy to make with microcomputers.
- Tooling costs are reduced, since templates and other fixtures are not required.
- Flexibility of operation is improved, as is the ability to produce complex shapes with good dimensional accuracy, repeatability, reduced scrap loss, and high production rates.
- Programs can be prepared rapidly and can be recalled at any time utilizing microprocessors.
- Less project work is involved.
- Faster prototype production is possible.
- Required operator skill is less than that for a qualified machinist, and the operator has more time to attend to other tasks in the work area.
- Improve the quality and accuracy of manufactured parts.
- Increase production throughput.
- Stabilize manufacturing costs.

5. Working

The system is comprised of five different modules in total; three of which are client modules for different platforms.

- Server for Windows

- Embedded Program for Microcontroller, and Hardware Circuit
- Bluetooth Client for J2ME mobile phones
- Wi-Fi Client for Windows laptops

5.1 Server for Windows

The server module is executed on a desktop PC running Windows. It sends commands to the microcontroller to control the relays, and accepts commands from clients connected to it. The push buttons on the left can be used to directly control the relays from the server side without using a client. If the relay is active i.e. the appliance is turned on, the button stays in a depressed position. Once the device discovery is complete, it displays a list of MAC address of any servers it has found. Select the desired server and press the Connect button.

Once it's connected to the server, it displays a list of appliances and their current status. The appliances can be turned on and off by checking or clearing the corresponding checkboxes. When an appliance is turned on or off, the server propagates the status to all the other clients connected to it.

Pressing the Start button connects to the access point specified in the configuration file and attempts to connect to the configured server IP. Once it has successfully connected to the access point, the signal strength is displayed as percentage in the upper left corner of the screen.

5.1.1 Connected Clients

A list of all the clients connected to the server either through Wi-Fi or through the Internet is shown in this list box. It shows the client's IP address and the remote port on the client side.

5.1.2 COM Port

The USB-to-Serial Bridge presents itself as a virtual COM port to the server. The port number that corresponds to the USB-to-Serial Bridge is chosen so that the server can communicate with the microcontroller.

5.1.3 Bluetooth Port

The BTSP protocol also functions through a virtual COM port. The port number that corresponds to the COM port to which the mobile phone is connected to is chosen.

5.1.4 Server Port

This is the port on which the server listens for incoming connections from the Wi-Fi network and from the Internet. The clients should also be configured to connect to this port number.

5.1.5 Communication Log

It logs all communication between the server and the microcontroller, as well as commands received through Bluetooth from clients.

5.1.6 Automatic Timing Controls

The server can be configured to automatically turn on or off particular appliances at specific times. Up to 14 different configurations for different timings can be set. Each horizontal row corresponds to a particular time and the checkboxes from left to right represent the relays. If the small checkbox inside the time spin box is checked then that time profile is active and the relays will be switched on or off at the corresponding time according to the 8 checkboxes. An empty checkbox means that the corresponding relay will be switched off. A ticked checkbox means that the corresponding relay will be switched on. A partially ticked (shaded) checkbox means that the corresponding relay will not be changed; it will be left unchanged when the profile activates automatically at the corresponding time.

For example in the given image at 6:00 PM, Relay 1 (Light 1) and Relay 2 (Light 2) will be switched on and Relay 3 (Night Lamp) will be switched off. The remaining relays will be left unchanged at whatever state they previously were.

5.1.7 Configuration File

When the program is closed, the settings are saved in an XML formatted file. The previous settings are loaded the next time the program is launched.

5.2 Microcontroller And Hardware Module

5.2.1 ARDUINO UNO Microcontroller

The microcontroller used is a Arduino uno manufactured by Microchip Technology Inc. It communicates with the server using Serial communication via a USB-to-Serial Bridge. It has multiple outputs which are used to control the relays. The microcontroller is programmed such that if it receives a lower case a-h it turns off the corresponding relay and if it receives an upper case A-H it turns on the corresponding relay. If it receives any

other input it responds with an error saying the input was unrecognized.

5.2.2 Ethernet Shield

The following development board is used to operate the PIC microcontroller. It provides an external oscillator crystal that is required for the functioning of the microcontroller, as well as easily accessible I/O ports. The development board and microcontroller are powered with +5V through the USB connection to the PC. The UART port on the development board is connected to the USB-to-Serial Bridge.

5.2.3 Relay Board

A relay board with eight electromechanical relays is used to switch on and off the appliances. The relay board is connected to one of the output ports on the microcontroller. The relay board requires +12V for operation and is powered by a transformer. If the mains supply delivers low voltage then the transformer voltage may drop below +12V. To overcome this, a higher voltage transformer is used and a 7812 voltage regulator is used to deliver a steady +12V to the relay board. The output port on the microcontroller is 8 bits wide. When logical one (+5V) is output on one of the bits, the corresponding relay is activated.

The live terminal input of each appliance is wired across the Common and Normally Open terminals of the relays, thus the power to the appliance is switched on or off depending on whether the relay is active or not.

For the purpose of demonstrating a working model, three 220V outlets have been attached the relay board. The maximum load switching capacity of each of the relays is given below:

7 amperes @ 125 volts AC

7 amperes @ 12 volts DC

5 amperes @ 240 volts AC

5 amperes @ 28 volts DC

5.2.4 USB-To-Serial Bridge

The USB-to-Serial Bridge used is based on the Prolific PL2303 chip. It accepts 0 to +5V TTL voltages and outputs the signal on a virtual COM port presented the PC. A MAX232N line driver is used to convert the 0 to +5V TTL levels to RS232 levels. The RS232 voltages are then sent through the PL2303 chip which connects to the PC via USB.

5.3 Bluetooth Client Module For J2me

The Bluetooth client is designed to run on mobile phones that are J2ME and MIDP 2.0 enabled. Nowadays most mobile phones support J2ME as well as MIDP 2.0 hence the user base for the Bluetooth client is very large. This is the most compelling reason to choosing J2ME as the development platform. When the application is started, it attempts to initialize the Bluetooth device. If the mobile phone doesn't have Bluetooth or doesn't support the J2ME Bluetooth API (JSR-82) an error is displayed.

On pressing the Search button, it attempts to search for nearby Bluetooth devices and tries to identify the Industrial machines controlServer running on the BTSP protocol. Once the device discovery is complete, it displays a list of MAC address of any servers it has found. Select the desired server and press the Connect button.

Once it's connected to the server, it displays a list of appliances and their current status. The appliances can be turned on and off by checking or clearing the corresponding checkboxes.

When an appliance is turned on or off, the server propagates the status to all the other clients connected to it. Similarly if an appliance is turned on or off from another client, the status is updated on the mobile phone in real-time. Pressing the Disconnect button ends the BTSP connection and returns to the Search screen.

Searching For Servers

Normally when a Bluetooth service is created, a unique UUID is provided at the time of creation so that the client side can be preprogrammed to connect to discovered services which match that UUID directly. However when the BTSP service is hosted by the PC, it hosts multiple services using the same UUID, each of which correspond to a different virtual COM port.

Thus when connecting via Bluetooth normally, the mobile phone will automatically choose the first service with the matching UUID that it locates. However this may not be connected to the same virtual COM port that the server is listening on.

Hence an additional step must be presented to the user on the mobile phone where the specific service to connect to must be selected. Once device discovery and service discovery have completed completely, a list of all MAC addresses that match the match the same UUID are presented to the user.

Since the same UUID is repeated amongst the PC's services itself, all the MAC addresses in the list will be the same, each one corresponding to a different virtual COM port. The user must then choose one among these to connect to. Coincidentally the list of MAC addresses

appear in ascending order of the name of the virtual COM ports on the server, so it is trivial to choose the correct address since it is known which virtual COM port the server is listening on.

5.4 Wi-Fi Client Module For Laptops

The Wi-Fi Client for laptops is visually similar to the server module and is designed to run on Windows. The push buttons on the left are used to activate or deactivate the relays and hence the appliances connected to them. On clicking on one of the buttons to activate it, a command is sent to the server to activate the corresponding relay.

Only if the server responds confirming that the relay has been activated does the button stay depressed on the client interface.

5.4.1 Server Address

The IP address of the Industrial machines controlserver to connect to is provided here. This can even be an IP address on the internet, thus allowing one to control the connected appliances from a remote location such as from one's office.

5.4.2 Server Port

The remote port on the server to connect to is provided here. This must be the same port that the server is configured to listen on.

5.4.3 Configuration File

When the program is closed, the settings are saved in an XML formatted file. The previous settings are loaded the next time the program is launched.

Some of the issues encountered in the server application were also prevalent in the laptop Wi-Fi client.

When the application is launched it reads the previous settings from an XML formatted configuration file. All the values read are checked to be valid for the corresponding data type, and whether they are within their allowed upper and lower bounds if any. If a particular option is corrupted or not present in the configuration file (due to a user manually editing it), a safe default value is assumed.

Updating GUI on Receiving Commands

Incoming commands from the network are received in a separate network thread. When a command to activate or deactivate a relay is received, the corresponding push button needs to be changed.

When the various menus were shown and hidden as the user selected options on the screen, it eventually caused problems such as some menu items not being rendered properly or menus not appearing at all.

This was attributed to the system running out of memory to render correctly with all the objects loaded at once. The solution was to dynamically create and destroy each of the menus and other items on screen such as the status texts.

When the application is launched it reads the previous settings from a plain text configuration file. All the values read are checked to be valid for the corresponding data type, and whether they are within their allowed upper and lower.

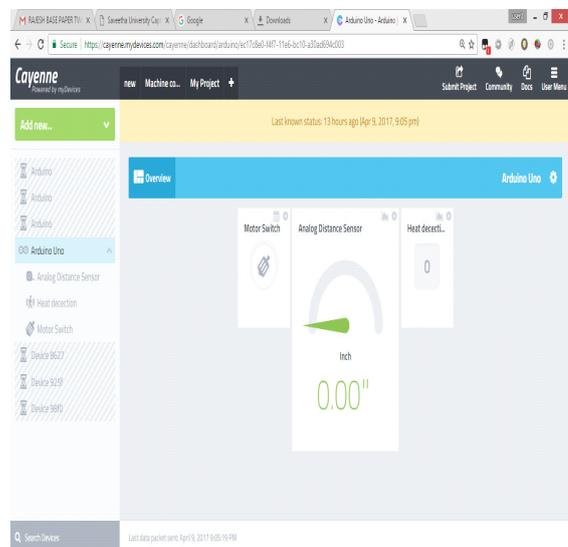


Figure 2. Cayenne Cloud Control

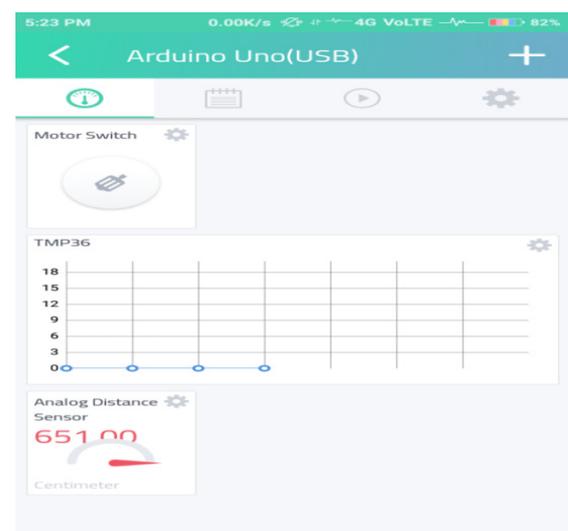


Figure 3. Sensor Graphs

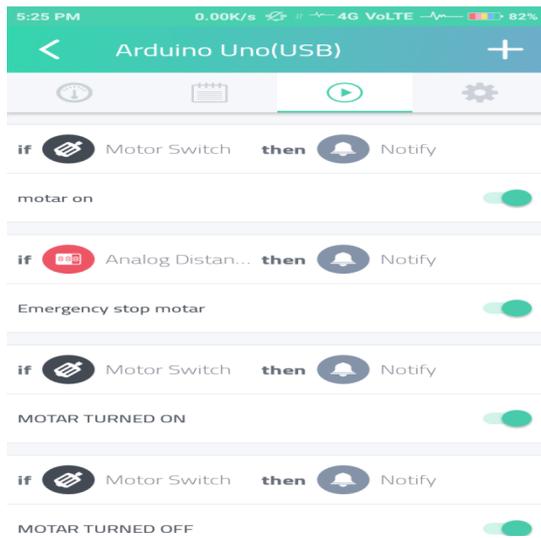


Figure 4. Mobile App Control



Figure 5. Demo Machine Control

6. Conclusion

In this project, we have a tendency to area unit managing the commercial machine mistreatment the advanced technology below embedded systems mistreatment Arduino at mega 2560 , we have a tendency to did management the stepper motor mistreatment GRBL library to control the motive force and if any human movement or unbroken the hand close industrial machine suddenly pir motion sensing element sight and stop or on alarm.

The Industrial machine control and monitoring system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. The client was successfully tested on a multitude of different mobile phones from

different manufacturers, thus proving its portability and wide compatibility.

Thus a low-cost Industrial machine control and monitoring system was successfully designed, implemented and tested.

Reference

- [1] Malinowski, and Hao Yu, "Comparison of Embedded System Design for Industrial Applications," *IEEE Trans. Ind. Informat.*, Vol. 7, No. 2, May 2011, pp. 244-254.
- [2] E. Monmasson, L. Idkhajine, M. N. Cirstea, I. Bahri, A. Tisan, and M. Wissem Naouar, "FPGAs in Industrial Control Applications," *IEEE Trans. Ind. Informat.*, Vol. 7, No. 2, May 2011, pp. 224-243.
- [3] Gu G.Y., Zhu L.M., Xiong Z.H., Ding H., "Design of a Distributed Multiaxis Motion Control System Using the IEEE-1394 Bus," *IEEE Trans. T. Harmon, M. Schoeberl, R. Kirner, R. Klefstad, K. H. K. Kim, M.R.Lowry*, "Fast, Interactive Worst-Case Execution Time Analysis.
- [4] Hu Chaobin, Li Wanli, and Xu Wuquan, "Study on the industrial system interpolation based on windows CE.NET and its real-time," Zunino, "Evaluation of EtherCAT Distributed Clock Performance," *IEEE Trans. Ind. Informat.*, Vol. 8, No. 1, February 2012, pp. 20-29.
- [5] Numerical control of machines - Program format and definition of address words - Part 1 : Data format for positioning, line motion and contouring contro*1 systems, ISO Std. 6983-1, 1982.
- [6] Andreas Jacobssona, Martin Boldtb, Bengt Carlsson, "A risk analysis of a smart home automation system". *Future Generation Computer Systems*, 56, 2016.
- [7] Avier Suarez,n, Jose Quevedob, Ivan Vidala, Daniel Corujob, Jaime Garcia-Reinosoa, Rui L. Aguiarb , "A secure IoT management architecture based on Information-Centric Networking", *Journal of Network and Computer Applications*, 63, 2016.
- [8] M. Fazio, A. Celesti, A. Puliafito, M. Villari, "Big Data Storage in the Cloud for Smart Environment Monitoring". *The 6th International Conference on Ambient Systems, Networks and Technologies*, 2015.
- [9] Muhammad Waseem Ahmada, Monjur Moursheda, David Mundowb, Mario Sisinnic, Yacine Rezgui "Building energy metering and environmental monitoring – A state-of-the-art.

