ISSN (Online) : 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 4, April 2017

Machine to Machine to Communication using CAN and RF in Manufacturing Industry

[1]Madhura B.M, [2] Kanmani B.S
[1] PG Student Department of Electronic and Communication
[2] Assistant Professor Department of Electronic and Communication
[1] [2] Dayananda Sagar University ,Bengaluru, Karnataka ,India

***Abstract*— Present Industries are being developed by more of electrical parts for efficient operation. Generally a machine was built with an analog driver-machines interface for indicating various machines status like voltage monitoring unit, Engine temperature etc., CAN bus and RFID network can be used to monitor and control various parameters in the industries. Large amount of man power and time consumption is required for monitoring and controlling industrial parameters. The automated parts should form a structured set of control activities corresponding to the physical equipment and processing tasks. In this project we are implementing CAN and RF network based Industrial monitoring and control application system on ARM. The ARM Microcontroller having interconnected CAN interfaces with advanced acceptance filters. User safety is also very important factor in Industrial areas and hence unmanned operation is always preferred over manned operation. To overcome the need of huge man power and time consumption this technology was developed which makes use of single person for monitoring and controlling the entire network.**

***Index Terms*— Controlling and Monitoring of temperature, Internet of things, voltage variation and load on machine**

I. INTRODUCTION

Generally in industries there are traditional network communications like RS232, RS485, etc. which are limited for short distances. Data acquisition based on single chip has limited processing capacity and real time reliability. With the development in ARM processor, efficient data acquisition and control in various fields can be achieved. Remote I/O data acquisition system developed in this project measures temperature, voltage monitoring etc. There are individual devices or larger subsystems of their own. Process systems can be in different operational states, such as _maintenance‘, _starting up‘ or _operating‘. In each state, they provide a set of capabilities that can be combined to perform the various stages of the process[5]. This can be achieved with the combination of both wired and wireless technologies i.e. CAN bus network with the RF technology, which is the main objective of our project. A typical smart sensor node consist of both digital and analog components, which allow the sensor data to be captured, transformed, analyzed, and transmitted to other nodes in the system, by applying the CAN protocol to a smart sensor network is a natural progression from existing sensor networks.

The CAN bus provides an ideal platform for interconnecting nodes and allows each node to communicate with any other node. Controller Area Network (CAN) protocol can be used

for the communication between nodes and by using RF protocol we can transmit and receive the data between two ARM in a machine by means of wireless and controlling of two machine is done. This technology is a cost effective one and it can be used in various applications like industries, automobiles, home etc.

II. RELATED WORK

Recent studies show that real time monitoring and controlling various parameters in the industries using ZigBee Communication integrated with CAN bus network. The method has been implemented in order to reduce the usage of wires used for communication purpose. The data transmission rate will be higher than other wireless systems [2]. This application is user friendly and can be achieved at a low cost.. The smart factory connects the machines, devices, logistics, and humans to perform the necessary coordination. The future smart factory and supply chains need ubiquitous communication among a production units, services, diagnoses, handheld devices, and enterprise systems in the push to design, manufacture, and service goods. This is fairly obvious to most forward-looking engineers, but reality shows that the exploding number of often connected sensors, controllers, and actuators is creating swarms of devices that are difficult to organize in an industrial network. For a smart factory to prevail, communication technologies will need to efficiently connect machinery over varying distances in a flexible manner with high security, robustness, and availability at a low cost[9]. Networks can be both wired and wireless, but wireless M2M protocols are increasingly used because they‘re convenient to install, use, maintain, and enhance[8].CAN protocol and ZIGBEE can be used in smart factory for wired and

ISSN (Online) : 2394-6849

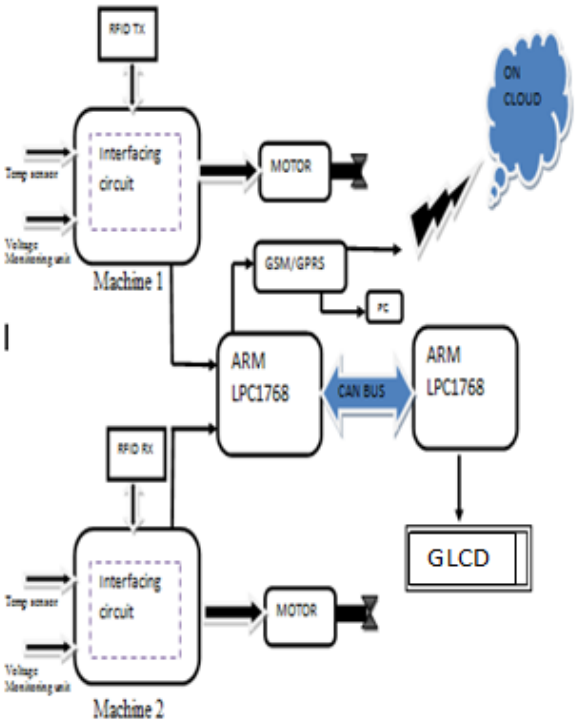
International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 4, April 2017

wireless communication between M2M to increase the reliability of communication. Machine to machine technology is widely applied to its robustness and availability which are demanded in critical environment where security or explosive hazards must be considered.

III. METHODOLOGY

This proposed system is being developed to monitoring and controlling the machines and information about the machines that will be sent to the caretaker via CAN Bus. This module consists of sensors for sensing, RF, CAN bus, ARM controller unit and the output. If the machines have this module, then each and every time the machines will be monitored and controlled with respect to parameters like TEMP,VOLTAGE, LOAD detection and all information will be sentto the care taker Via CAN bus and is uploaded to the server using IOT for further analysis. Here sensors will monitor machines each and every time, also RF communicates between two machines and controls the production i.e.,Example Suppose, if Machine-1 and Machine-2 are running at 50% load, if the temperature of Machine-1 increases, then through RF both machines will communicate, then the load onmachine-1 will be decreased by 25% increasing load onmachine-2 by 25% thus maintaining same production. This information is sent to the ARM controller. The ARM controller analyses the signal and sends the same informat ionto the caretaker via CAN bus module. If any fault is recognized while monitoring parameters, that message will be displayed on GLCD and also in the PC of the user with the proper message. Data is continuously uploaded onto the server for further analysis. If any fault is detected in the machine, then system will send a pre-generated SMS to dedicated mobile. It also has an alarm, which facilitates the safety needs of industry. It alarms the workers, working in critical conditions, in the industry. It also allows us to schedule task and supports total unmanned operation of the plant. And data is uploaded on the cloud and monitored.

BLOCK DIAGRAM:



VI. BLOCK DIAGRAM DESCRIPTION

A. INTERFACING CIRUIT

1. ***Power supply unit:*** This section needs two voltages viz.,+12 V & +5 V, as working voltages. Hence specially designed power supply is constructed to get regulated power supplies.
2. ***Mono-stable Multi vibrator:***
   This has only ONE stable state (hence their name: ―monol),and produce a single output pulse when it is triggered externally.
3. **Variable power supply:**
   LM317T with 3 pins, supporting an input voltage in the range of 3V to 40V DC and delivers a stable output between 1.25volt to 37 volt DC. It is a very high performance IC contains a built in current limiter, built in thermal overload protection &safe area protection.
4. ***Buffer s:***
   Buffers are normally used to provide extra current drive at the output but can also be used to regularize the logic present at an interface.
5. ***Driver s:***
   This section is used to drive the relay, where the output is complement of input and is applied to the drive, with current amplification.

ISSN (Online) : 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 4, April 2017

6. Relays:

It is an electromagnetic device which is used to drive the load connected across the relay and the o/p of relay can be connected to controller or load for further processing.

B. RF TX AND RX

The RF transmitter and receiver are built around the ASIC and common passive and active components, which are very easy to obtain from the material shelf. The circuit works on Very High Frequency band with wide covering range. The Carrier frequency is 147 MHz and Data frequencies are 17 MHz, 19 MHz, 22 MHz & 25 M Hz. It is noted that ASIC or Application Specific Integrated Circuit is proprietary product and data sheet or pin details or working principles are not readily available to the user.

C. ARM LPC1768 MICROCONTROLLER

The LPC1768 Cortex-M3 microcontroller features a high level of integration and best-in-class peripheral support at frequencies up to 120 MHz The architecture features a multi-layer AHB bus that supports multiple high-bandwidth data streams running simultaneously from peripherals such as Ethernet, USB, or CAN. In the series each MCU is pin-compatible with NXP's ARM7 LPC2x00 and Cortex-M4/M4F LPC4000 series [4]

D. CAN BUS PROTOCOL

The various features provided by a CAN Bus Protocol are
Listed below [6]:

1. Serial communication and 1 Megabit per second speed
2. Multi-Master Protocol and supported for distributed control Systems.
3. Compact Twisted Pair Bus line and Wiring less Complicated, economic
4. Reliability.
5. Robust in noisy environments.
6. Error detection and Error handling.
7. More safety and comfort.
8. Priority Signal Setting.
9. Cost Effective.
10. All devices on the network receive every bit of Information sent on BUS.
11. Multi-casting and Broadcasting is supported by CAN
12. Easy to changes and implement too.
13. Additional elements (E.g., control units) are easy to
Integrate.
14. Installation place exchangeable without electric problems.

CAN TRANSCEIVER MODULE

The CAN Transceiver Module i.e. MCP2551 is a high-speed CAN & mostly used as a voltage converter .It convert general voltage level to CAN voltage level at the transmitter & CAN voltage level to general voltage level at the receiver. CAN bus uses two dedicated wires for communication. The wires are called CANH and CANL. When the CAN bus is in idle mode, both lines carry 2.5V. When data bits are being transmitted, the CANH line goes to 3.75V and the CANL drops to 1.25V, thereby generating a 2.5V differential between the lines. Since communication relies on a voltage differential between the two bus lines, the CAN bus is not sensitive to inductive spikes, electrical fields or other noise[6].

E. SENSORS

1. TEMPERATURE SENSOR: Thermistors are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature. Negative Temperature Coefficient (NTC) thermistors exhibit a decrease in electrical resistance when subjected to an increase in body temperature and Positive Temperature Coefficient (PTC) thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature. U.S. Sensor produces thermistors capable of operating over the temperature range of -100° to over +600° Fahrenheit. Because of their very predictable characteristics and their excellent long term stability, thermistors are generally accepted to be the most advantageous sensor for many applications including temperature measurement and control.

ISSN (Online) : 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 4, April 2017

F. GSM:

GSM Shield (SIM 800a): The SIM900 which is a complete Quad-band GSM/GPRS solution comes in a SMT module which can be embedded in customer applications. Featuring an industry-standard interface, The SIM800 delivers GSM/GPRS are of following frequencies 850/900/1800/1900MHz performance for Data, voice, SMS and Fax in a small form factor and with low power consumption. SIM900 can fit almost all the space requirements in the M2M application with dimensions of 24mm x 24mm x 3 mm. Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm, SMT type suit for customer application, An embedded Powerful TCP/IP protocol stack Based upon mature and field-proven platform, backed up by our support service, from definition to design and production.

G. GLCD (Graphic Liquid Crystal Display)

GLCD is used in a project to visualize the output of the application. GLCD can also used in a project to check the output of different modules interfaced with the microcontroller. GLCD plays a major role in a system to see the output and to debug the system module wise in case of system failure in order to rectify the problem.

V. EXPERIMENTAL SETUP

Experimental setup consist Machine-1 and Machine-2 controlling temperature and voltage monitoring unit and ARM and CAN bus protocol is use to monitoring the Machines and alerting Care taker by message and uploading information on cloud.

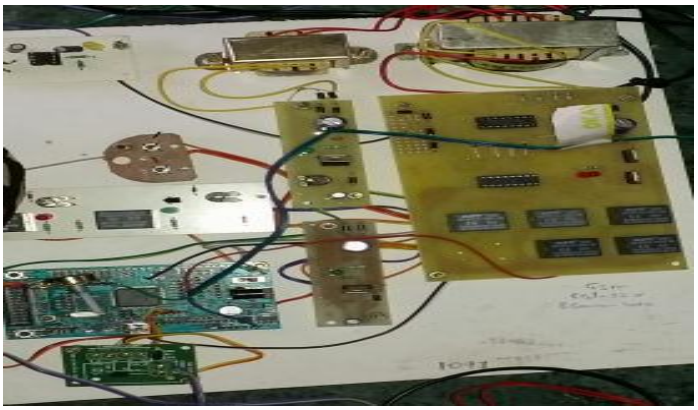


Fig 1. Machine1 and Machine 2 communication using RFID

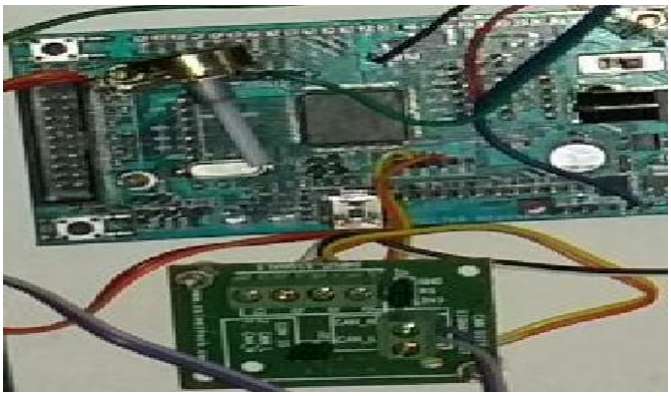


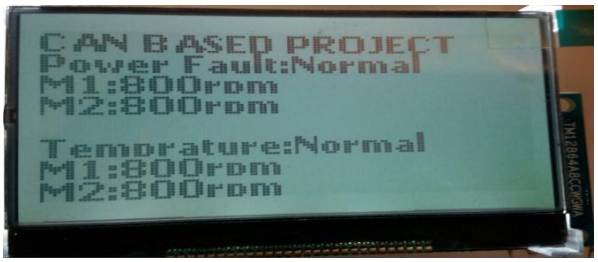
Fig 2. ARM LPC1768 and CAN BUS interface.

VI. RESULTS

The proposed system is designed and developed to obtain following results. As described in the block diagram, GLCD displays the Industrial parameters & Diagnosed fault parameter which are measured and recorded in tabular column below. If any error or fault occurs in any of the sensors used for machine then error message is displayed on GLCD & also same error message sent to PC. Following is the snaps of GLCD showing temperature and voltage parameter values.

TEMPERATURE	MACHINE 1	MACHINE 2
NORMAL(33deg)	800 RPM	800 RPM
VARIED(45deg)	550 RPM	1050RPM

POWER	MACHINE 1	MACHINE 2
NORMAL(12V)	800 RPM	800 RPM
VARIED(16V)	OFF	1050RPM



ISSN (Online) : 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 4, April 2017

VII. CONCLUSION

This project proposes the implementation of CAN and RF for monitoring and controlling the industrial parameters without disturbing the production, even if fault occurs in one of the machines. ARM LPC1768 is used as the master controller which is used for the processing the data. By RF M2M controlling is done. Any error or default in machines is displayed on LCD and message is sent to a PC. The small size of the CAN transceiver IC and the micro controller with integrated CAN solution reduces the size and cost of the node considerably. With the use of high speed CAN transceiver the data is transmitted and received in faster rates with high level of integrity. The processing time associated is also small. Industry monitoring is an important class of sensor network applications with enormous potential benefits for the industrials. Layer features are to be used, therefore providing full compatibility in Industrial Monitoring & Controlling.

VIII. FUTURE SCOPE

M2M Communication plays an important role in an industry. Efficient communication between M2M will improve the production of Industry. This can be achieved by both wired and wired less communication by CAN bus, RS232, ZIGBEE, RFID. In Future combination of wired and wireless technology lead to bidirectional communication between M2M and self controlling and monitoring of a machines resulting in Smart Industry.

REFERENCES

[1]Thakor Bhishmapalsinh litendrasinh, Mr.Shripad Deshpande, ― Implementation of CAN Bus Protocol on XENOMAI RTOS on ARM Platform for Industrial Automation‖, 2016 International Conference on Computation of Power, Energy Information and Communication
(ICCPEIC).

[2] Vijay S. Kale, Madan B. Matsagar, Avinash D. Sonawane, Chandrakant L. Ambekar, ―Remote Temperature Monitoring System Using ARM, Arduino and ZigBee‖, International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 5, May 2016.

[3]Syed Shafiullah, Renuka Sagar ,―Implementation of Controller Area Network (CAN) and ZigBee Protocol for Industrial process monitoring and control‖, June 2015 | IJIRT | Volume 2 Issue 1 | ISSN: 2349-6002.

[4]LPC1769/68/67/66/65/64/63 32-bit ARM Cortex-M3 microcontroller; up to 512 kB flash and 64 kB SRAM with Ethernet, USB 2.0 Host/Device/OTG, CAN Rev. 9.6 — 18 August 2015.

[5] B.Tulasi Swathi, D. Prashanth, B. Kishore Babu, ―Implementation of Can and Zigbee Networks Based Industrial Monitoring and Control Applications On Arm 7 Processor‖, International Journal Of Engineering And Computer Science ISSN:2319-7242.Volume 3, Issue 11 November, 2014 Page No. 9301-9304.

[6] Texas Instrument, ―Introduction to the Controller Area Network (CAN)‖, SLOA101A–August 2002–Revised July 2008.

[7] ArunaY.Jagtap, ― Industrial Parameter Monitoring System Using CAN Bus‖ , International Journal of Emerging Research in Management &Technology ISSN: 2278-9359 (Volume-3, Issue-9)

[8] Michael Weyrich, Jan-Philipp Schmidt, and Christ of Ebert, ― Machine-to-Machine Communication‖

[9] INDUSTRIE 4.0 (Smart manufacturing for future).