MONITORING AND CONTROLLING OF SMART EQUIPMENTS IN MANUFACTURING INDUSTRY USING IOT APPLICATIONS

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Abstract—**This paper describes the implementation of controlling physical parameters through IoT applications with GSM module. The ever increasing requirements for information being accessible at any time, from any place, regardless the type of remote device or planned operation, together with the need of complete control of a specific scenario or device has paved the way towards the next technological revolution: Internet of Things (IoT). In this project, the parameters are sensed by the respective sensors and are monitored by the individual microcontrollers. Finally, the values are displayed with the help of individual LCD displays. The microcontroller is connected to the PC through zigbee bus and the output will be displayed in that PC with the help of RS232 serial communication. This data is stored in the Pc and uploaded to the cloud. The system is reliable and stable. It is the most effective and most economical means of equipment safety monitoring.**

Keywords－**Zigbee, GSM, IoT, Android, Microcontroller, Sensors.**

I. INTRODUCTION

Now- a- days, the industrial monitoring field requires more manual power to monitor and control the industrial parameters such as pressure, temperature, water level, etc…This is one of the most upcoming issues in the industrial sectors. If the parameters are not monitored and controlled properly, it leads to a harmful situation. Most of the industries are facing these kinds of situation because of some manual mistakes. In that kind of harmful situations, again the manual power is required to control the parameters. Sometimes, if this control process may not be handled properly, it results in an occurrence of major accidents. So, every process in the industrial sector requires more manual power which is also having issues with the unavoidable manual mistakes. With the upcoming technologies, it is very easy to overcome the greater issues in the industrial automation.

The term *Internet of Things* was introduced by K. Ashton in the context of supply chain management and it describes a system where the digital world is connected to the physical world forming a global network [1], [2]. A report of McKinsey Global Institute regarding the disruptive technologies defines Internet of Things as to the "use of sensors, actuators, and data communication technology built into physical objects – from roadways to pacemakers – that enable those object to be tracked, coordinated, or controlled across a data network or internet" with the goal of creating value [3]. Over the last years IoT is foreseen as the solution for the ever-increasing demand for connectivity between peoples, organizations, companies, gadgets and devices and it was born from the desire to achieve software real-time control and access to information.

Based on machine-to-machine (M2M) concept, fuelled by the development of smart sensors and actuators, together with communication technologies (Wi-Fi, Bluetooth, RFID) and supported by cloud computing technologies, IoT becomes a reality and its goal is to make "things" more aware, interactive and efficient for a better and safer world. Therefore, any smart device that can be addressed by means of a communication protocol can be part of the Internet of Things.

The objective of this project is to design the monitoring and control system for industrial parameters using IoT. This system mainly reduces the high manpower requirement in the industrial monitoring field by monitoring the overall industrial parameters through a single PC with the help of IoT application. This system also provides an automatic control of parameters during an emergency situation.

II. SYSTEM ANALYSIS AND REQUIREMENTS

A. GSM MODULE

A GSM modem is a specialized type of modem, which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone [4]. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it may be a mobile phone that provides GSM modem capabilities.
GSM/GPRS RS232 Modem from rhydo LABZ is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz it is very compact in size and easy to use as plug in GSM Modem [5]. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port .The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface.
The modem needed only 3 wires (Tx, Rx, GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V) to send & Read SMS [5].

B. TEMPERATURE SENSOR

A simple temperature sensor using one LM35 precision
Integrated-circuit temperature device with an output voltage linearly-proportional to the centigrade temperature. It can measure temperature from -55c to +150c. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and stand by current is less than 60μA.The purpose of this sensor in this system is to monitor the temperature and to regulate Air Cooler system .It is designed that whenever the temperature goes beyond 35° C the Air Cooler system has to turn on. Temperature sensor LM35 is interfaced to the microcontroller. The conversion of Celsius and Fahrenheit is done by certain formula. The output is displayed in the serial monitor. When the temperature goes above 35C the cooler system gets ON automatically.

C. IR COUNTER MEASUREMENT

An infrared sensor is an electronic instrument which is used here to detect and count the motion of cones on conveyer [6].

IR sensors are capable of detecting motion of object and heat emitted by an object. IR detectors are specially filtered for Infrared light; they are not good at detecting visible light. On the other hand, photocells are good at detecting yellow/green visible light, not well at IR light.

D. PROPOSED SYSTEM

Several architectures of how the implementation of IoT should be done are proposed Nevertheless, most of them can be summarized by a simplistic The goal of the research project introduced in this paper is to deliver connectivity to smart manufacturing equipment in order to allow them to be controlled and monitored by software applications running on Android compatible devices. Therefore, among the identified enablers and issues that need to be addressed, the ones of interest for this project are listed below:

- Networks of smart equipment enhanced with embedded distributed intelligence to deal with scalability challenges.
- Micro-electromechanical systems and sensors for augmented applications or fore knowledge and awareness of things.
- Plug – and – produce and interoperable thins for efficient things communication.
- Extended communication capabilities for intermittent network connectivity and unique identification.
- Energy efficient and reconfigurable things.
- Remote human machine interaction and interfaces; maintenance service and support.
- High computational power and information processing, data storage and data availability.

A manufacturing system is built out of smart reconfigurable manufacturing resources that are linked by means of wired or wireless communication between them and to the manufacturing system control and information management layer. Sensors and actuators are part of Reconfigurable manufacturing resources, which, if joined together, can create more complex resources obtaining extended functionalities. Smart reconfigurable resources can be considered things because they are addressable by using a communication network (wired or not) and they have the ability to process, store, send and receive data and monitor or control devices (sensors, actuators, etc.). Even more, they have the ability to communicate with other reconfigurable manufacturing resources and react to changes in order to maintain a specified process parameter set-point by different means.

A smart reconfigurable manufacturing resource is enhanced with distributed intelligence, providing local control for the physical manufacturing resource, plug – and – play capability and high computational power. Even more, the hardware and software building blocks of a reconfigurable manufacturing resource can be rearranged in order to obtain a different then before functionality with a minimum effort and delay

There are three major expected outputs from the proposed architecture at the end of the project. First, the development of smart reconfigurable resources, allowing to rearrange their building blocks in order to fit process needs by selecting the right software applications from the enterprise or manufacturing cloud within the constraints of the available hardware modules. Out of these resources, more complex reconfigurable manufacturing resources can be achieved, leading also to reconfigurable manufacturing systems. Their development will be supported by highly interoperable modular hardware and software blocks, generic embedded systems, real time embedded operating system, intelligent information management algorithms and informational electrical- mechanical interfaces.

E. BLOCK DIAGRAM

There are three part of system. The remote input/output data acquisition and control system based on embedded ARM platform has high universality. Sensors are used for process monitoring and for process control.

Each I/O channel can select a variety of electrical and non electrical signals like current, voltage, resistance etc. This signal is taken into LPC2148 & digitized using the inbuilt ADC. External memory is used to store this data; we can directly show this data on LCD display which is connected & the memory is act as a data base during Accessing web server mode & GSM mode.
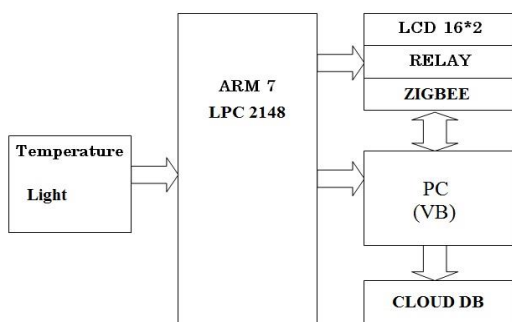

Fig.1 Block diagram of proposed system.

III. RESULTS

The proposed system is successfully implemented and desired outputs are obtained. When the power supply is given through a dc battery, the process starts and the GSM SIM starts to find the network and the sensors start sensing the corresponding parameters and are displayed on the LCD. And simultaneously the results are stored in PC and the same is uploaded to the cloud successfully. The authorised person has access the data from any place at any time and can monitor the parameters through IoT successfully. The temperature is displayed in centigrade, and light in terms of LUX.

The figure 2 shows the overall project module and the desired outputs are successfully obtained.

The figure 3 shows the data sheet of temperature and intensity of light for each varying time 2-3 seconds and is monitored continuously using IoT.

The figures 4 and 5 show the variation in temperature and intensity of light with the time and are captured using MATLAB simulator.

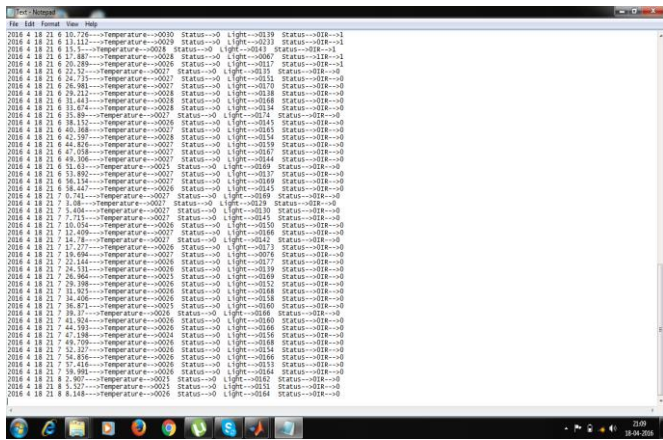Fig. 2 Complete project module

Fig. 3 Data sheet of the module showing values of parameters.
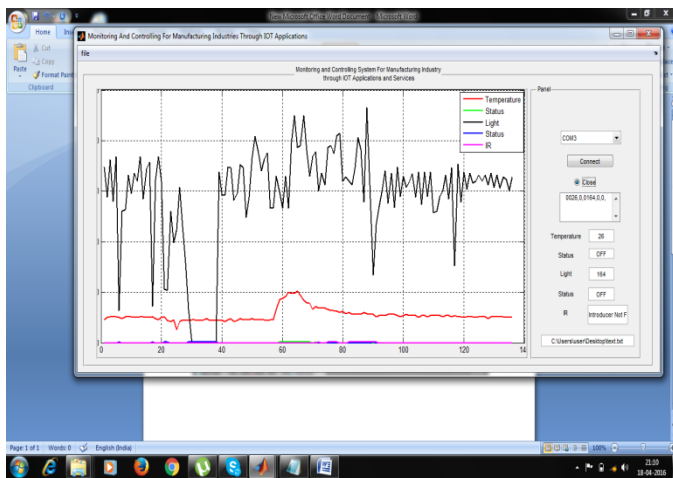

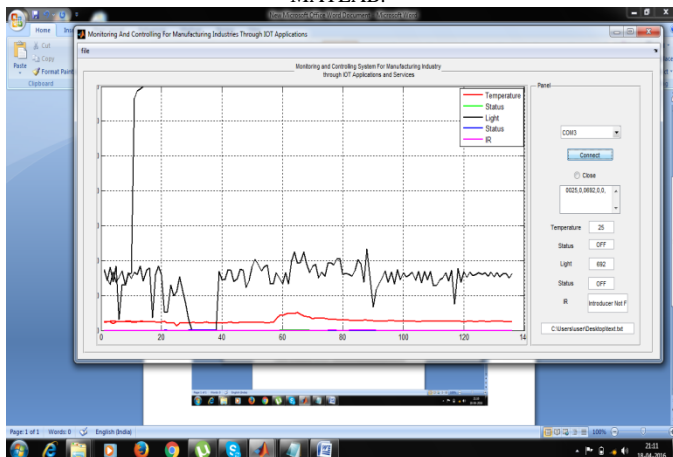Fig. 4 Variation of light and temperature with time captured using MATLAB.

Fig. 5 Variation of light and temperature with time captured using MATLAB.

IV.   CONCLUSION

Conclusions that can be extracted out of this paperwork and experimental project denote the fact that the proposed connectivity solution between a manufacturing resource and a monitoring device meets our needs at this moment. Still, for using the Wi-Fi module at its full performances a microcontroller with better processing power and memory must be selected. Process data, in this case temperature, has been successfully transferred using the Wi-Fi shield (from Roving Networks) from an embedded design and two Android compatible devices, used for monitoring. Also by sending specific commands, a small fan can be turned on or off by an Android

Compatible device via the Wi-Fi shield. The user or operator has access to additional useful information like: the time since the embedded design or Manufacturing resources is on, and information about maintenance of the resource.

Based on the result of this work and our vision about how IoT can be implemented into the manufacturing field, the following future research directions are established:

- Developing an intuitive, use-centered graphical human-machine interface for Android devices that can provide extended access and control to information stored within the embedded design and to its functionalities.

- Development of software applications that can be downloaded from enterprise cloud to a manufacturing resource and used by this resource for process control and monitoring.

- Development of a network of manufacturing resources for scalability testing

V.   REFERENCES

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