IMPLEMENTING SCADA Systems Using IOT

Project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering/Information Technology

By

Akshit Bhardwaj(141306)

Under the supervision of

Dr. Vivek Sehgal

to

Department of Computer Science & Engineering and Information Technology

Jaypee University of Information Technology Waknaghat, Solan-173234, Himachal Pradesh

Candidate's Declaration

I hereby declare that the work presented in this report entitled **" Implementing SCADA Systems Using IOT For GYM Automation "** in partial fulfillment for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted to the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from August 2017 to December 2017 under the supervision of **Dr.Vivek Sehgal** (Associate Professor **,**Computer Science Department).

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Akshit Bhardwaj
141306

This is to certify that the above statement made by the candidates is true to the best of my knowledge.

Dr. Vivek Sehgal
Associate Professor
Computer Science Department
Dated:

Acknowledgement

I wish to express my deep gratitude to Dr. Vivek Sehgal (**Associate Professor**, Computer Science Department) for guiding me through our project and helping me with his invaluable support and encouragement that defines our determination which otherwise would have left us derailed.

I would like to extend a hearty thank you to JUIT faculty members who supported us morally and imparted their advice throughout the completion of this work. Finally, I would also like to thank my colleagues for the inspiration and motivation which was so needed in the times of crisis and setbacks.

Akshit Bhardwaj
(141306)

Content Table

List of abbreviations:

SCADA:Supervisory Control and Data acquisition. IOT: Internet of Things

IC: Intergrated Circuit

RTU:Remote Terminal Unit

PLC:Programmable Control Logic

GUI:Graphical User Interface

ICS:Industrial Control Systems

HMI-Human Machine Interface

List of Graphs

 List of Tables

ABSTRACT

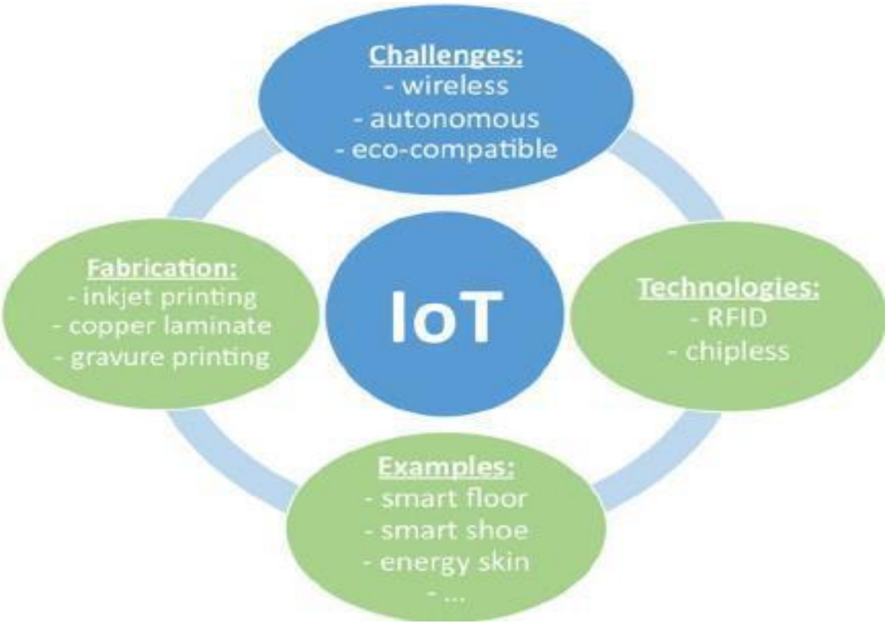
<u>Supervisory control and data acquisition (SCADA</u>) is known by the name as its a control system architecture using computers , data networks and GUI's to achieve top-level supervisory management system. Many other peripheral devices such as programmable logic controllers and discrete PID controllers are employed to interface with the process plant and/or specific parts of the machinery. The operator interface enables monitoring and issuing of process commands, such as controller set point changes, are handled through the SCADA supervisory computer system. However, the real-time control computations are performed by networked modules in the field itself connector embedded to the field sensors and actuators, hence negating a bottleneck at the processing end at the supervisory control. The SCADA concept is means of ways to achieve a universally remote/mobile access to a various local control modules manufactured and designed to allow access through standard protocols. In today's world, large SCADA systems are very synchronous to distributed control systems in their functioning, but they provide for multiple means of interfacing with the plant by controlling large-scale processes such as multiple sites monitoring, and work over large distances, that span beyond the reach of tradional LAN or wifi networks in terms of bit widths, reliability, redundancies, strength of material, circuit designs etc. However there are concerns about SCADA systems being vulnerable to cyberwarfare / cyberterrorism attacks but their small scale implementations over private and local networks application can be managed in terms of security and scalability and provides a more streamlined functioning for the small enterprise holder.

1.1 INTRODUCTION

The IoT infrastructure allows for inanimate objects in the real world to be sensed and controlled remotely across an already established network infrastructures for better direct interfacing if not integration, of the physical world into digital systems, resulting in accuracy in anticipation and economic/resource efficiency in addition to reduced human intervention, hence making management and security more streamlined. When IoT is manifested with sensors and actuators, it becomes an instance of a more universal and compatible class of cyber-physical systems that can help us realize technologies such as smart grids, virtual power plants, smart homes, intelligent transportation, smart cities, irrigation systems , smart gyms etc, by having a more accountable, reliable and secure environment by implementing appropriate methods for accountability, monitoring and surveillance. Hence implementing the architecture of SCADA Systems for GYM automation can be viable solution for large/small scale enterprises using the universality of the ponciple of IoT and SCADA Architecture where a single mast monitoring is done.

Although a centralized system proved to be a cumbersome task to achieve as the resources were expensive for example complicated sensors that had to have their outputs processed by the management modules itself etc used to prove a bottleneck for the system which had to process incoming data as well as manage and maintain the system, these overhead tasks caused a bottleneck and implmenting SCADA system technology was not feasible for small enterprises. However with the introduction of cheaper and better sensor circuitry that can have digital yet precise readings and an already virtually omnipresent network infrastructure known as the internet of thing, the benefits of SCADA Systems can be reaped by the small enterprise holders as well.

The term "Things", can pertain to a variety of definitions in terms of devices such as vitals monitoring implants in medicine, biochip implants on flora and fauna for conservation pursposes, cameras streaming live feeds in areas where live surveillance is important, automobiles with built-in sensors, BIO vital analysis devices for environmental/food/pathogen monitoring, current sensors monitoring electrical consumption/generation , field operation devices that assist firefighters/soldiers in search and rescue operations. Scholars suggest regarding "things" as an "inextricable mixture of hardware, software, data and service" that is connected to the infrastructure of an virtually omnipresent repository we know as the internet and thus it can help make the machinery at GYMs be connected to the internet and can perform more tasks over its intended operation with minimal change in it's over all structure in the initial phases, as better GYM machineries can also be achieved that is more in harmony with principles of SCADA, as well as IoT. But that could only be achieved once enough machine data is acquired over time so as to implement it in the internal working structure of the machinery



A number of IoT devices today are made for consumer use such as connected transportation(private/public), entertainment ,Smart home/offices, wearable devices, quantified self, connected healthcare, highway management, even appliances such as washer/dryers, robotic vacuums, air purifiers, ovens, or refrigerators/freezers that use Wi-Fi for remote monitoring and are more energy efficient as they can adjust their energy consumption by sensing their environments. Principles of IoT are even applied by administration these day for better subsidy delivery and other administration purposes such as sanitation, transport etc. Consumer IoT provides for better user experience and interfaces through smart and more human compatible in their making and design.

Although a few consumer applications have been in the bad of the critics for their lack of redundancy and their inconsistency and companies and manufacturers have been criticized for their rush into IoT without implementing proper security measures, creating devices of questionable value, and risking security for mere marketing purposes.

1.1 PROBLEM STATEMENT

Regular gym equipment provide a means for exercise undergo lots of wear and tear through their usage. Furthermore there is a huge amount of mechanical work that is being done but there is certainly no means of measuring how much this wear and tear is and also the one working one the machine cannot asses their workout . Professional trainers can only estimate the amount of work being done by supervising a person’s workout and that is a cumbersome task when it comes to multi facilities gym equipped with significant numbers machines, it gets hard for a gym owner to keep track of his machine's wear and tear, security. and with the help of iot better performance analysis can also be made for gym's customers.

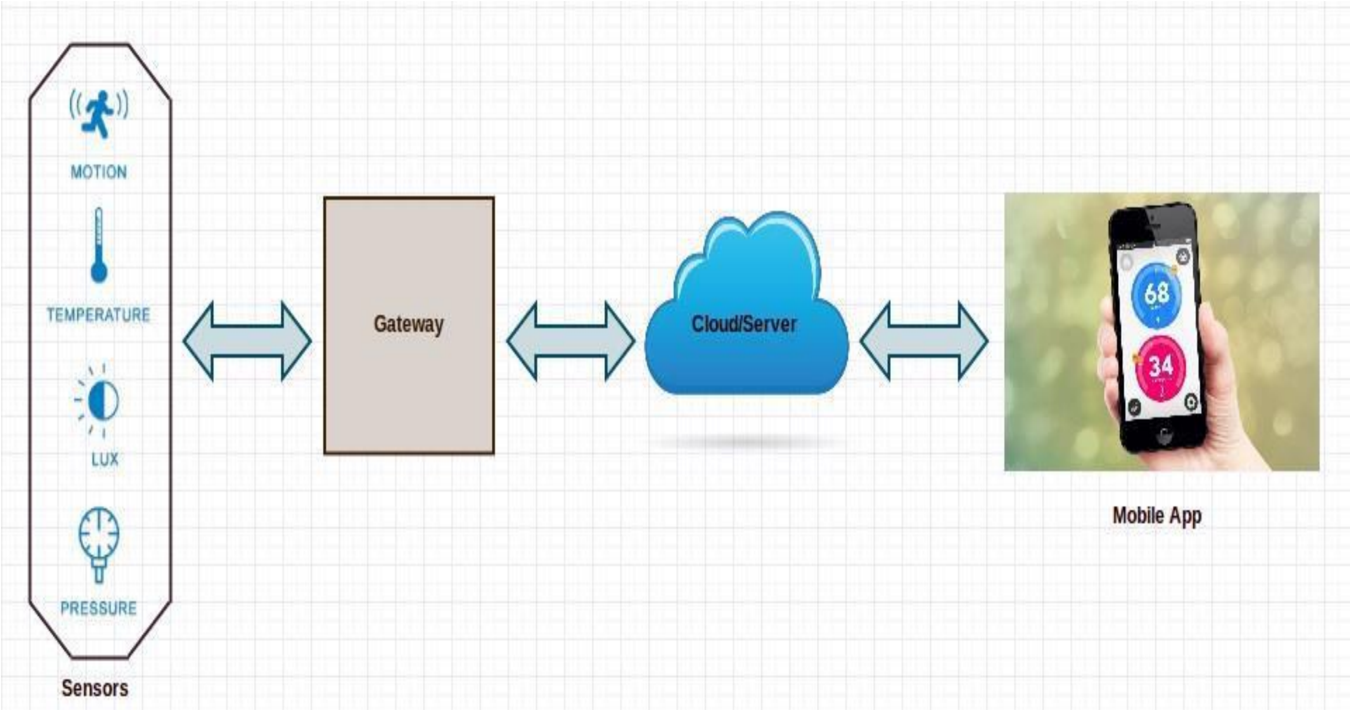
Hence our aim is to build a continuous machine monitoring system , using hall effect sensor in coupling with few more redundant sensor systems as RTU’s to better manage the performace of a machine and the over all gym environment by using usage history and storing it in a database. It can go a long way in helping a GYM owner/trainer to assess a machine’s performance and have a more secure and reliable surveillance of a GYM.

1.2OBJECTIVES

Our objective is to develop an automated system which can monitor almost any industrial application. In our project we are developing a system through which we can automate a gym under the assumption that every machine that is being operated on in a gym has some mechanical energy which can be harnessed and gauged using hall effect principle and sensors working on the principle.

The main purpose of the project is not to create the energy but to acquire the data and establish surveillance and security not only from instances like burglary but also as redundant fire alarm, automatic repairs reminder, establish a human to machine relationship in terms of negating a first person human supervision of the whole process . It will help the gym operator to gauge better readings and thus enhance the efficient usage of the machine as well as help them manage the whole workout more data based.

1.2 METHODOLOGY



1.3 METHODOLOGY (Contd..)

The sensor units detect changes in the environment like change in temperature, motion detection to detect whether a mchine user is present and if he's a valid user and also acts as a data accumulating unit. In our project we’ve used Digitial Ammeter as the main sensory unit.

The ammeter calculates the current and hence the voltage is obtained.

The control unit used is the ARDUINO board which interfaces the data to establish control through various sensors and actuators.

The data obtained (current) is processed in the processing unit and threshold current is set up.

Automated system design and alert sign for the threshold current.

Thus in this way we can generate an environment where different machines communicate with each other and thus all the different gym machines can be treated as things and the data is collected and control is established via centralized contolled SCADA.

CHAPTER-2

Literature Survey and Reviews

"Xiaofeng et al He states that privatization and deregulations of enterprises, the changing requirements have led to a rise in needs for accurate information analysis from multiple sources within DW and better performance solutions will be needed to represent the new data repository of SCADA system." Utilities have already started taking advantage of this new technique and many others plan to follow as the industry evolves with this new tool and applications in the evolution of the SCADA system.

"With the integration IoT the growing landscape oof SCADA systems can be a very welcome change with the introduction of many operation specific modules such proximity sensor, non intrusive heart monitors etc, the principle of SCADA can be implemented in enterprises large and small." As the internet evolves and the need for dedicated network infrastructures decreases and the objects and things around the world speak a universally understandable language."

"Jian Wu et al describes the Supervision Control and Data Acquisition (SCADA) system is a communication and control system used for monitoring, operation and maintenance of energy infrastructure grids with harsh deadline for critical tasks and implementations at large scale as compared to traditional applications."

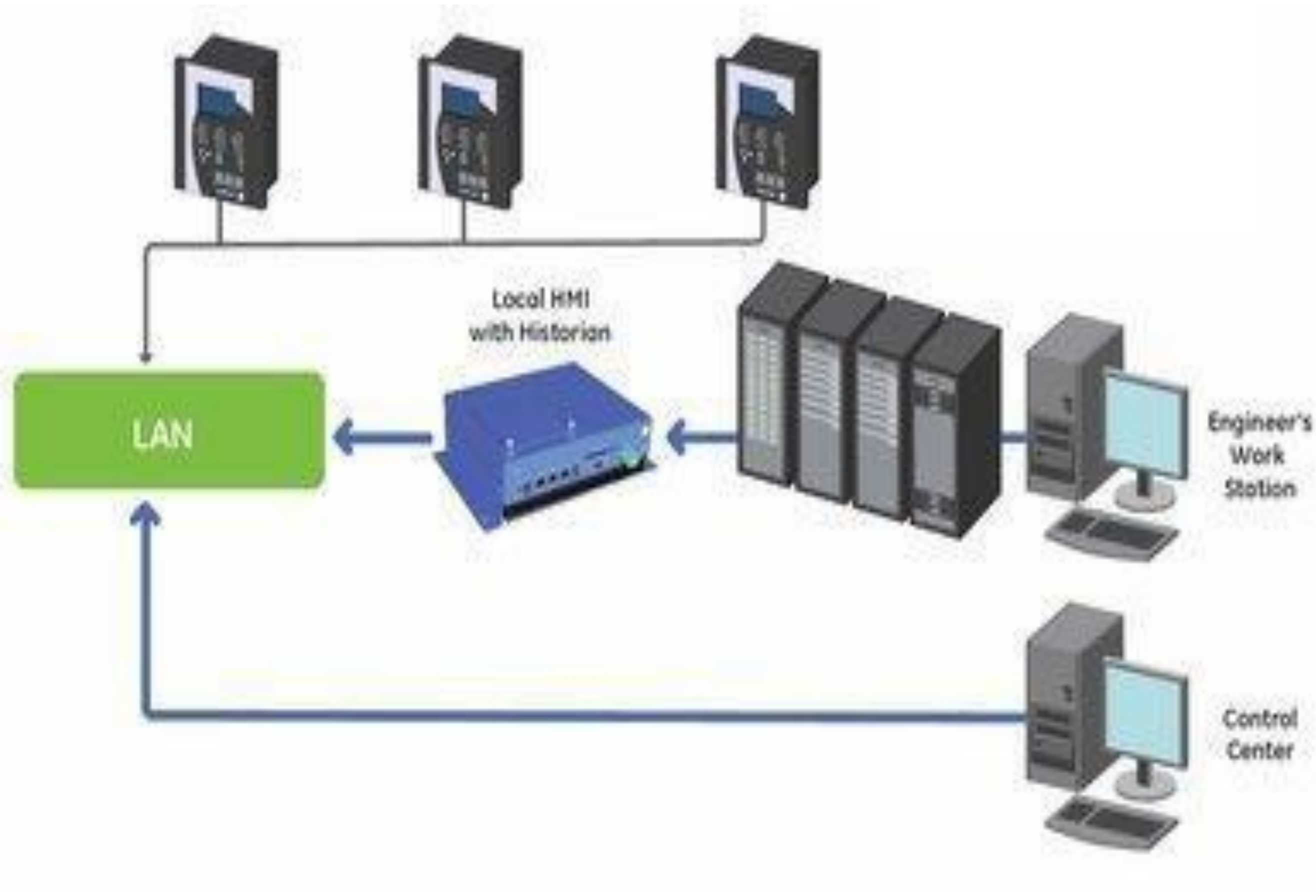
"Im see iterates the Electric utilities deem it increasingly necessary to better monitor, analyze and control a distribution systems. As planning and operation of the grid is increasing in complexity on one hand Real-time analysis is deemed necessary to achieve acceptable operational efficiencies and quality of service."

In case of a Smart Gym although there is no actual distribution is going on, but from the perspective of the enterprise owner he is distributing a service through his/her machines to the people who are paying for the service he is providing. hence the machines become a critical part of his operations, and a better streamlined secure monitoring system would obviously benefit a small enterprise owner as further increase in operation would only cost him a little to accommodate the monitoring structure as the network that was the expensive part of establishing the system, has already been made virtually omnipresent.

"William J. Ackerman describes the use of IEDs in substations will bring about many changes in the design and implementation of the SCADA/EMS/DMS system as increased data volume and protocols requires new methods for data transmission, processing and storage." Newer methods for checking out the transmission of data from a substation IED to a control station are required for if the task is to be accomplished in a reasonable amount of time as over time the older IED become vulnerable to cyber attacks and moreover efficient sensing mechanisms are being developed and a more compatible systems can be achieved for better and more secure implementation of SCADA Systems using IoT.

"New versions of EDs pertaining to more inter-compatible protocols already are being deployed in facilities to accomplish this evolving principle." Moreover, highly efficient systems can be developed as additional available data will lead to more accurate and reliable application programs such as state estimation, load flows, contingency analysis, emergency warning, maintenance alarms etc. The improvements in these programs will, in the long run, result in the ability to operate an enterprise with greater safety, reliability, economy and efficiency.

"B. Stojkovic describes the Each EMS (Energy Management System) relies upon the SCADA system that gathers the system's data , processes them and issues control commands." The AGC (Automatic Generation Control) is one the most important function of EMS. A SCADA system is characterized by its geographical spread, the amount of data, a complexity of belonging equipment, but also by a very long period for the finalization and a very high investment costs. The fast developments in these systems are a challenge to for newer safety and security parameters as these plants are operating under huge costs and looking at the trends these sensors networks will be connected on the same global networks that can help us develop infrastructure that are more weather and time wither resistant using data repositories and their smart analysis will be the need in coming as most of the network infrastructure is going virtually global, the demand for actual analog raw data has risen many folds over a matter of years and it is estimated that the demand will keep on growing as the remotest parts of the world are getting connected to the internet. SCADA Systems can help develop a more centralized but decentralized in itself environment for small enterprises and have a better understanding of their businesses.


Local HMI
with Historian
LAN
Engineer's
Work
Station
Control
Center

Literary Survey On Overall Risk Assessment

Published work related to risk assessment is rather difficult to categorize. Several different aspects define the research, primarily the amount of the overall process to be tackled. Risk assessment starts with risk identification, then risk analysis, follows with risk evaluation and ranking, and ends with the management and treatment phases.

Detailed interdependency models and simulations of the following categories have been made and aggregate supply and demand tools which evaluates the total demand for an infrastructure service and the ability to provide it with dynamic simulations to examine infrastructure operations, disruption effects, and downstream consequences, agent based models which model physical components and their interactions and operational characteristics, physics based models that analyze aspects of infrastructure with standard engineering techniques, population mobility models primarily for transportation and social network study, and Leontif Input-Output models which provide an aggregated, time-independent analysis of generation, flow, and consumption of commodities among infrastructure sectors (Rinaldi, 2004). Such modeling and simulation abilities are integral to infrastructure risk analysis

	Traditional SCADA System	IIoT SCADA System
Purpose	Remote monitoring and data acquisition	Improving Overall Equipment Effectiveness (OEE)* and process-wide overview of seed data for long-cycle system management.
Control	Supervisory control	Optimized proactive control
Reports	Historical trend charts	Analytics for new business models
Alarms	Immediate-action management from within the OCC (Operation Control Center)	Dispatch action tasks to anywhere through mobile devices

Many critical infrastructures are coupled which puts them at great risk to cyber attacks as often times they are remotely controlled and managed by SCADA systems. However in small enterprises, where the demand for more accountable systems has risen, they can operate in a local network environment as well which can operate off the grid totally bypassing the risk of a cyber attack.

Moreover, Typical SCADA systems are a very centralized topologically, but with trends changing over time and as circuits got cheaper and more complex a lot of the computational tasks that can be delegated on to the RTU, which was often a main concern in SCADA Systems getting bottlenecked at the controls end, and often reducing overall efficiency of the systems. Using IoT, we get a broader perspective at implementing a SCADA systems principles for an unorthodox implementation in small scales enterprises, using the flexibility of IoT technology, where the sensors and actuators have more intelligence embedded into them and the main control is free to implement more complex tasks such as security and surveillance, making small enterprises run more efficiently with the usage of data.

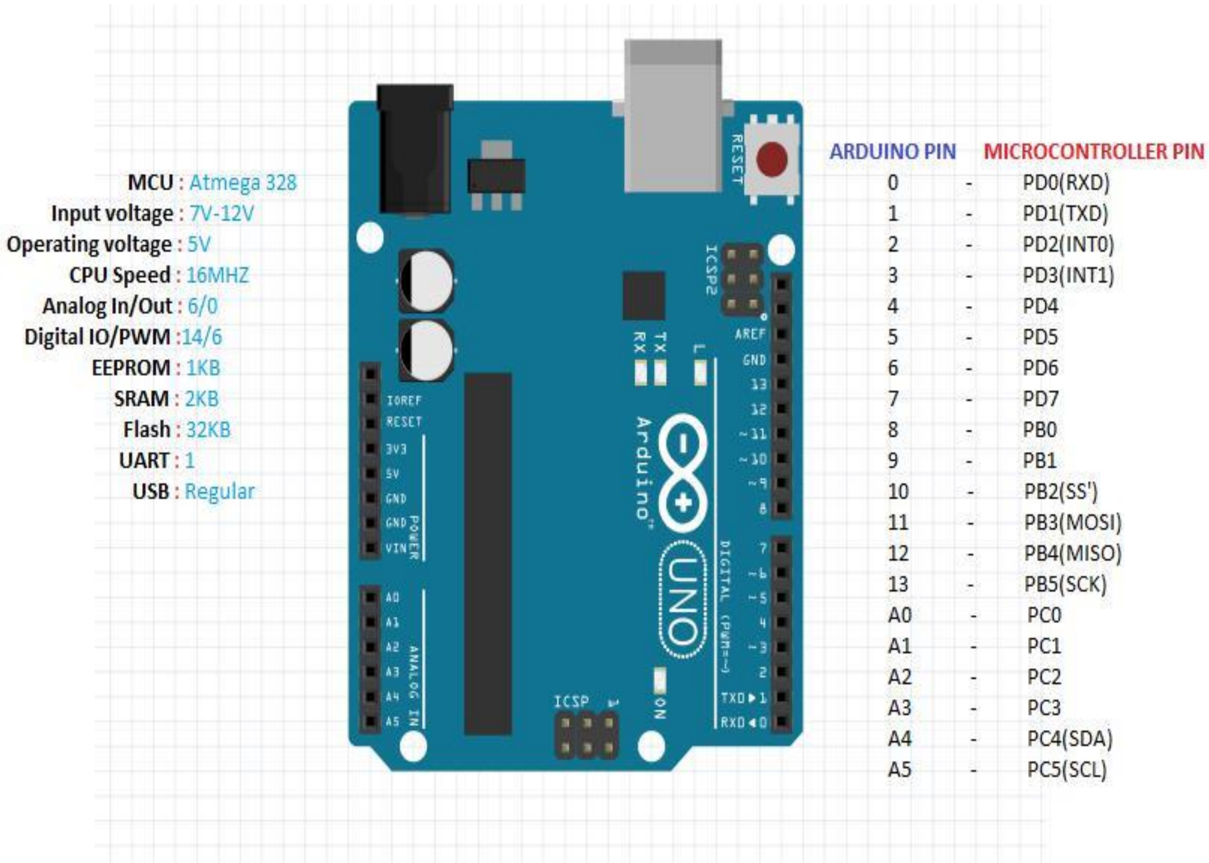
Chapter-3
System Development

Hardware Components Used :

Arduino Uno
Current Sensor ACS712
10k variable resistor
1 LED
1 Peizobuzzer
Memory card
USB inteface
Temperature Sensor
Push button
Rasberry pi computer
IP camera
Servo motor

THE ARDUINO UNO :

The Arduino Uno is an open source prototyping platform, programmed in embedded C, with a microcontroller board base equipped with 14 digital input/output pins out of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, and a reset button. It is packaged with everything that is needed to support the microcontroller; with a single USB interface or a simple AC-DC adapter.



The Uno is equipped with the Atmega16U2 (Atmega8U2 up to version R2) that has the facility to be programmed as a USB-to-serial converter, which makes it easy to develop extensive circuits without the need of a large paraphernalia of debugging tools. Revision 3 of the board has the following new features a stronger RESET circuitry, hence it's a more reliable platform than its predecessors.

Atmega 16U2 replace the 8U2, supporting a 16 bit structure.

USB Overcurrent Protection:

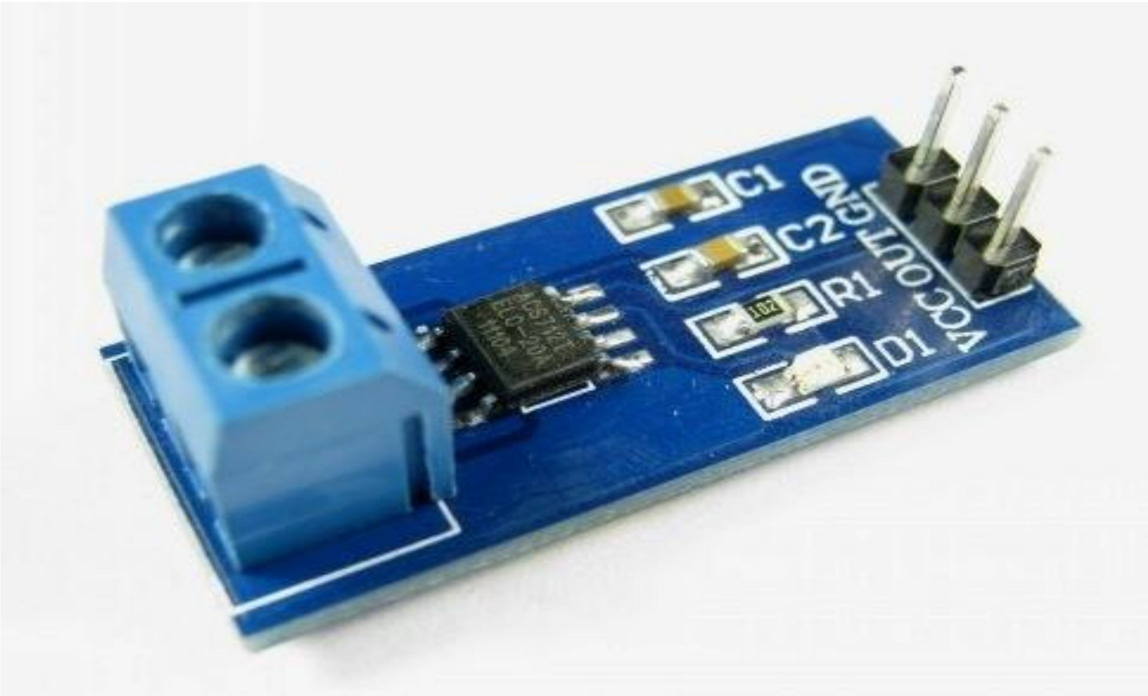
The Arduino Uno has a resettable polyfuse that protects the computer's USB ports from short-circuiting and excess current draw, hence a more reliable testing and debugging environment is achieved.

Input and Output:

Each of the 14 digital pins on the Uno can be used as an input or output, operating at 5 volts, each pin has a threshold of 40 mA and has an internal pull-up resistor of 20-50 kOhms thus protecting the usb interface from overdraw of current.. Additionally, some pins have specialized functions. The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of precision , but they can only be used as inputs. Analog outputs can only be simulated using the PWM pins as a dedicated Digital to Analog converter is missing on the original chip.

Current Sensor ACS712 :

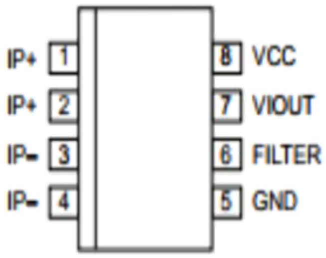
The ACS712 provides precision solutions for AC or DC current sensing in industrial, commercial, and communications systems due to its sturdy build and simple circuitry. The device package allows for easy implementation with only 3 pins and can measure a 20 Ampere in both directions and it finds applications in motor control, load detection and management of critical circuits, switch mode power supplies, and excess current fault protection and can help in monitoring the real time energy consumption of appliances.



Absolute Maximum Ratings

Characteristic	Symbol	Notes	Rating	Units
Supply Voltage	V_{CC}		8	V
Reverse Supply Voltage	V_{RCC}		–0.1	V
Output Voltage	V_{IOUT}		8	V
Reverse Output Voltage	V_{RIOUT}		–0.1	V
Output Current Source	$I_{IOUT(Source)}$		3	mA
Output Current Sink	$I_{IOUT(Sink)}$		10	mA
Overcurrent Transient Tolerance	I_P	1 pulse, 100 ms	100	A
Nominal Operating Ambient Temperature	T_A	Range E	–40 to 85	ºC
Maximum Junction Temperature	$T_J(max)$		165	ºC
Storage Temperature	T_{stg}		–65 to 170	ºC

Pin-out Diagram



Terminal List Table

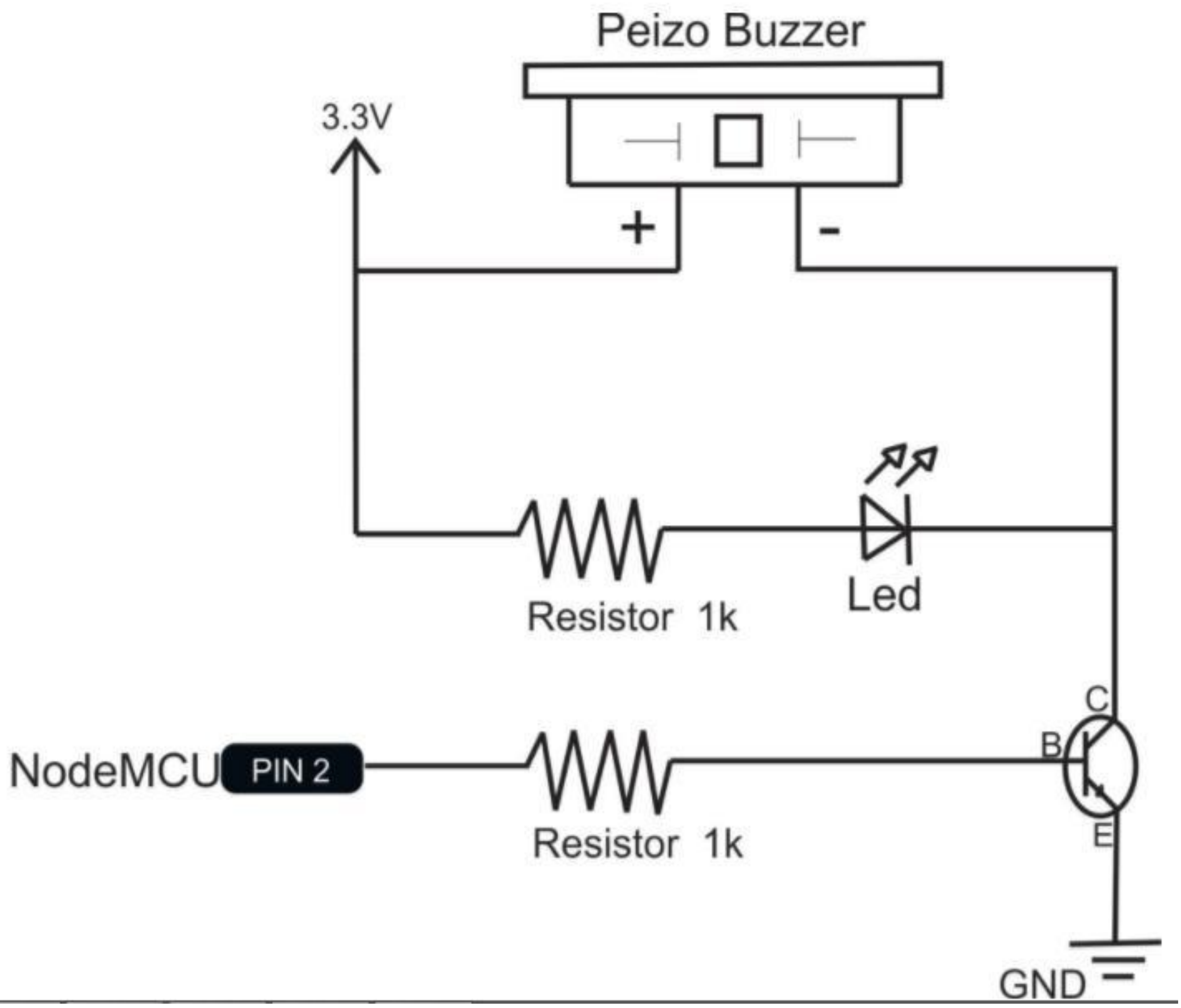
Number	Name	Description
1 and 2	IP+	Terminals for current being sampled; fused internally
3 and 4	IP–	Terminals for current being sampled; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

10k variable resistor :

A variable resistor consists of a track that provides the resistance path between the two terminals of the device are connected to both the ends of the track and a third terminal is connected to a wiper that decides the motion of the track and the resistance across the terminals. The motion of the wiper through the track helps in increasing and decreasing the resistance and helps us to regulate voltage or resistance across the terminals and also in test case generation and acts as analog means of test case generation and regulating voltage across terminals.

Peizo buzzer

A Peizo buzzer is a device that is used to generate a beep sound (generally a warning or alert in embedded system) using piezo electric properties and PWM. It is a two leg device where the longer leg is positive. If a voltage is supplied it generates beep sound. Through analog write volume of beep can manipulated and different melodies/beep tones can be generated



Rasberry pi :

The Raspberry Pi is a small single-board computers developed the Raspberry Pi Foundation, in the United Kingdom to promote the teaching of basic computer science and embedded technology and robotics. Its a general purpose computer designed to to work on low powered circuits and gives a computational advantage in embedded systems and OS libraries make many complex tasks like monitoring, surveillance and maintaining data bases and maintaining an internet connection, als o complex computations like graphics processing and can also be used as a web access point.

IP Camera :

An **Internet Protocol camera**, or am **IP camera**, is a digital video camera having, can have a two way digital connection via a computer network and the Internet unlike analog cctv. Although most cameras that do this are low quality webcams as is needed for most low priority surveillance, the term *IP camera* is usually applied only to those used for surveillance that can be directly accessed over a network connection but their applications may further be extended for better purpose graphics processing as the image resolution is far superior with these ip cameras as compared to their analog counterparts, and can be furthered in their applications with technologies like facial recognition, gesture control etc. Commonly employed for surveillance, these cameras have a better internet compatibility and ease of design in its circuitry. They are also more energy efficient as they do not need a high powered analog to digital converter for transmission.

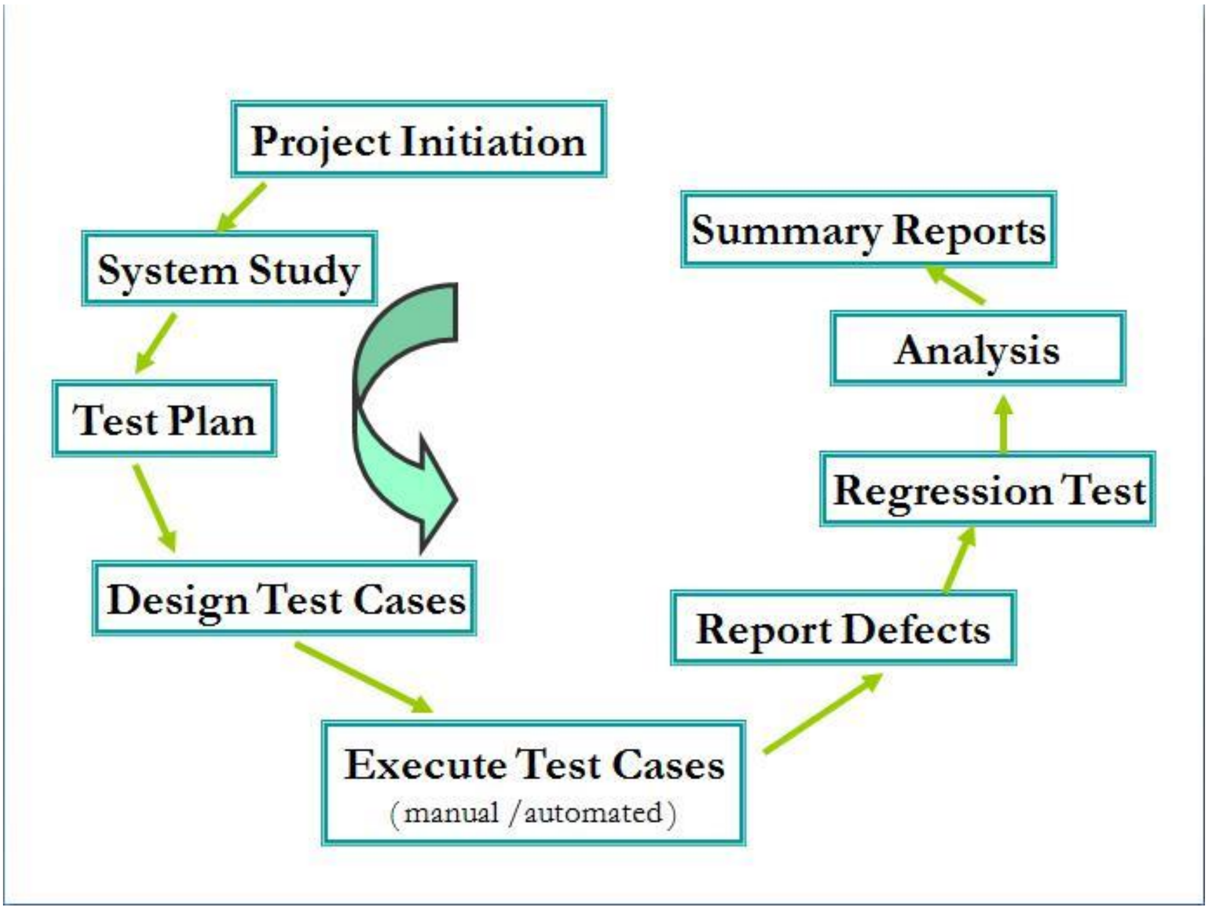
An IP camera is typically either centralized using a central network video recorder (NVR) to handle the recording, video and alarm management. Decentralized (no NVR needed, as camera can record to any local or remote storage media) topologies also exist and has apt applications in surveillance and monitoring purposes with further developments in their application and of course both these topologies come with their own security and privilege risks.
IP cameras communicate easily with the internet protocols and with coupling of other sensors they have versatility in their applications and usage.

Chapter-4
Performance Analysis

TESTING :

Software Testing is necessary because we all make mistakes, although some of those mistakes are trivial, but even those could even lead to ravesties if they're made in case of highly sensitive systems such as dams or any other security purpose. To check the software using various tools of simulation whether software or hardware integration is an important task so as to guarantee secure and reliable operations of SCADA Systems.

Working under the assumption that our work might have a few mistakes despite all the careful measures, vastness of the projects make it vulnerable to blind spots and anticipated, hence multiple methods of testing are employed so as to ensure a smooth functioning of the system.



Testing Techniques

Software Testing:

It is a method to test the program made or the application (running) to check for any errors when the desired input is given. There are various kinds of testing namely:

I. **Unit Testing:**

Integration of the current sensor was succesful wchich would meaure the value of the machine's mechanical output and was simulated using 10 k variable resistance to simulate every magnitude of machine's performance.

II. **Integration Testing:**

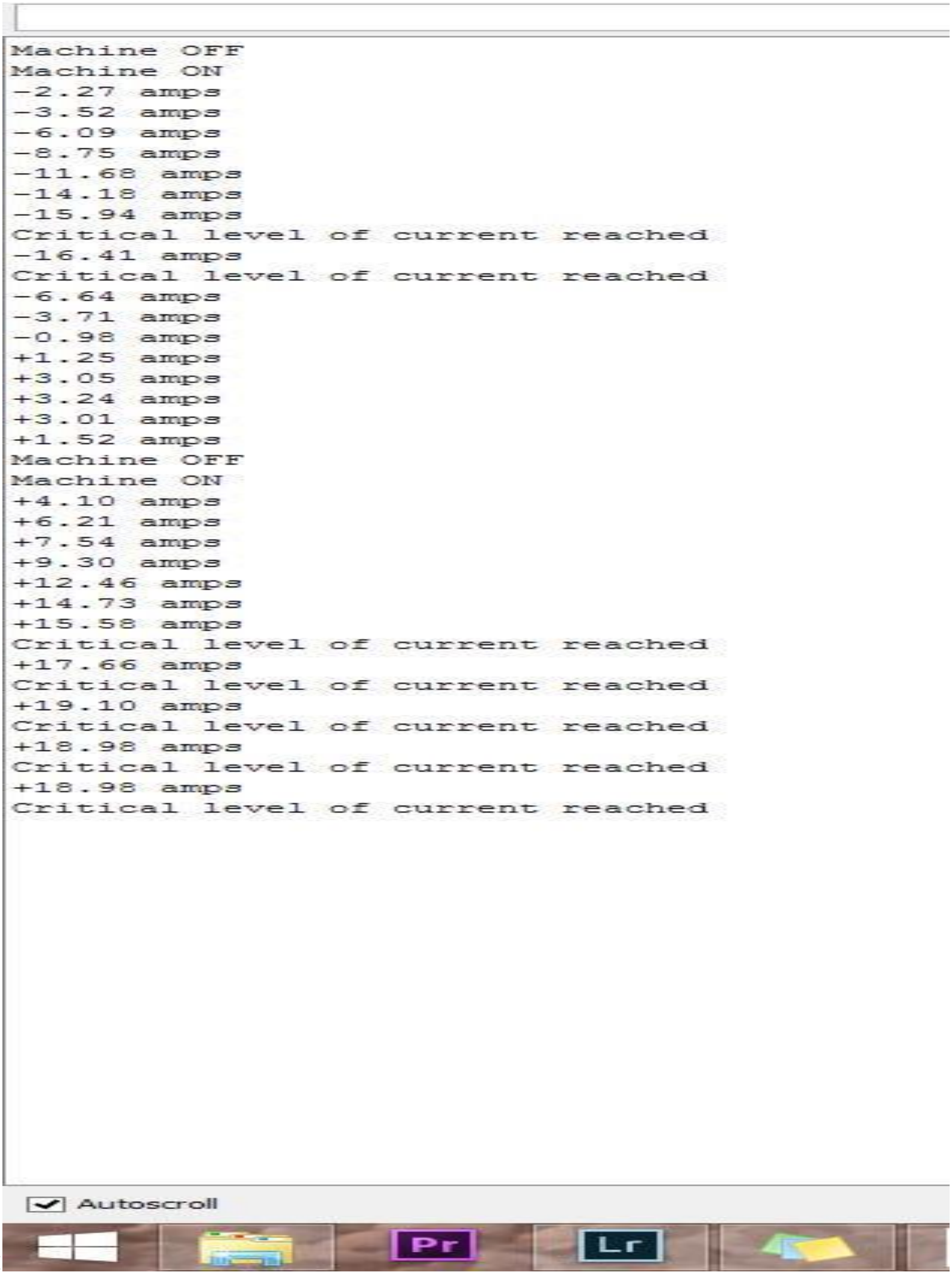
Other sensors like proximity, pressure, temperature were integrated along with an actuator for an electro-mechanical, piezo buzzer and ip camera lock and their integration was tested successfully.

III. **System Testing:**

Real world simulation of the code and sensors was performed using physical methods like flicking the proximity sensor, raising the temperature of heat sensors and trigger warnings were generated.

IV. **Acceptance Testing:**

TEST SUBJECT 1

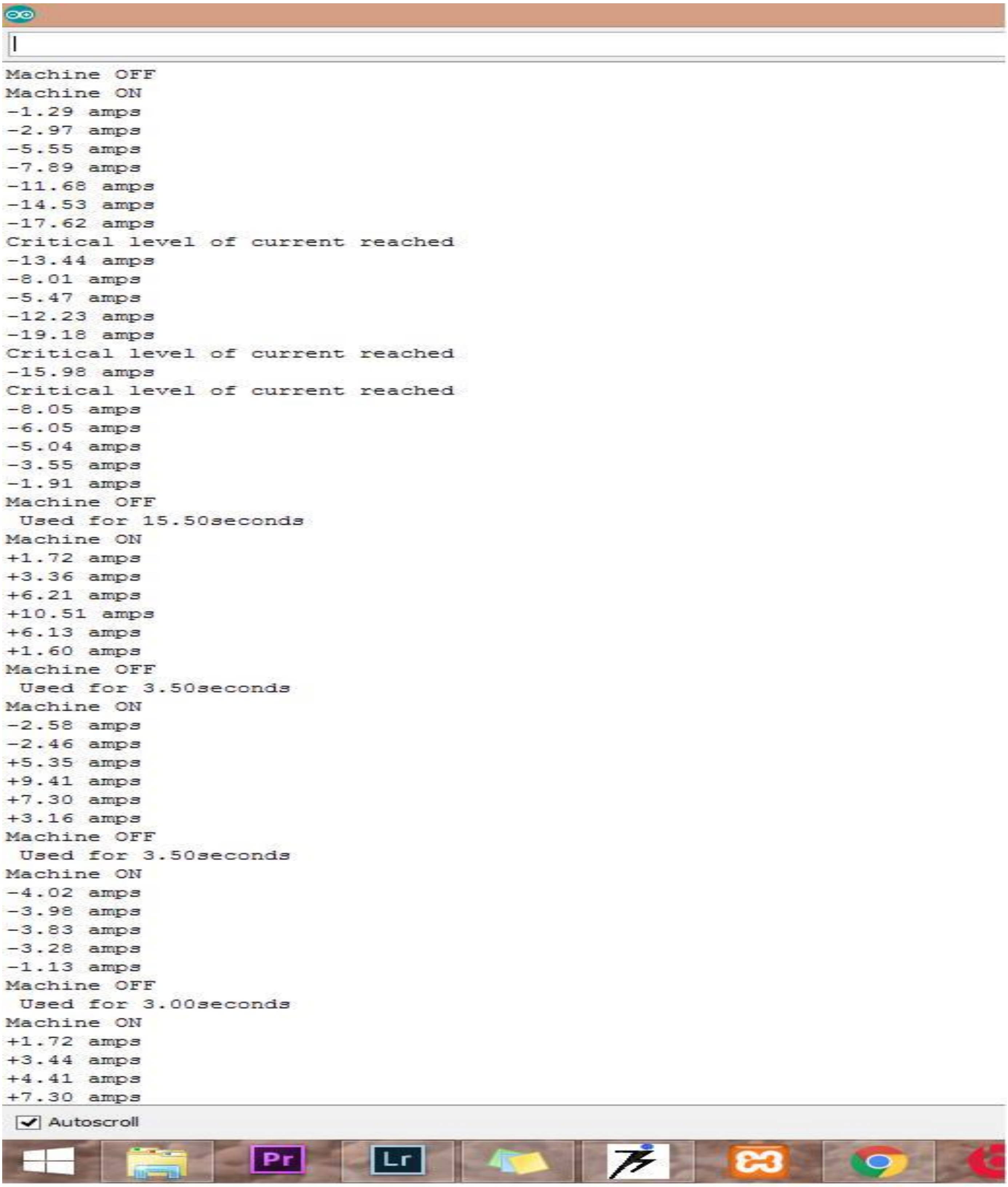


:

TEST SUBJECT 2

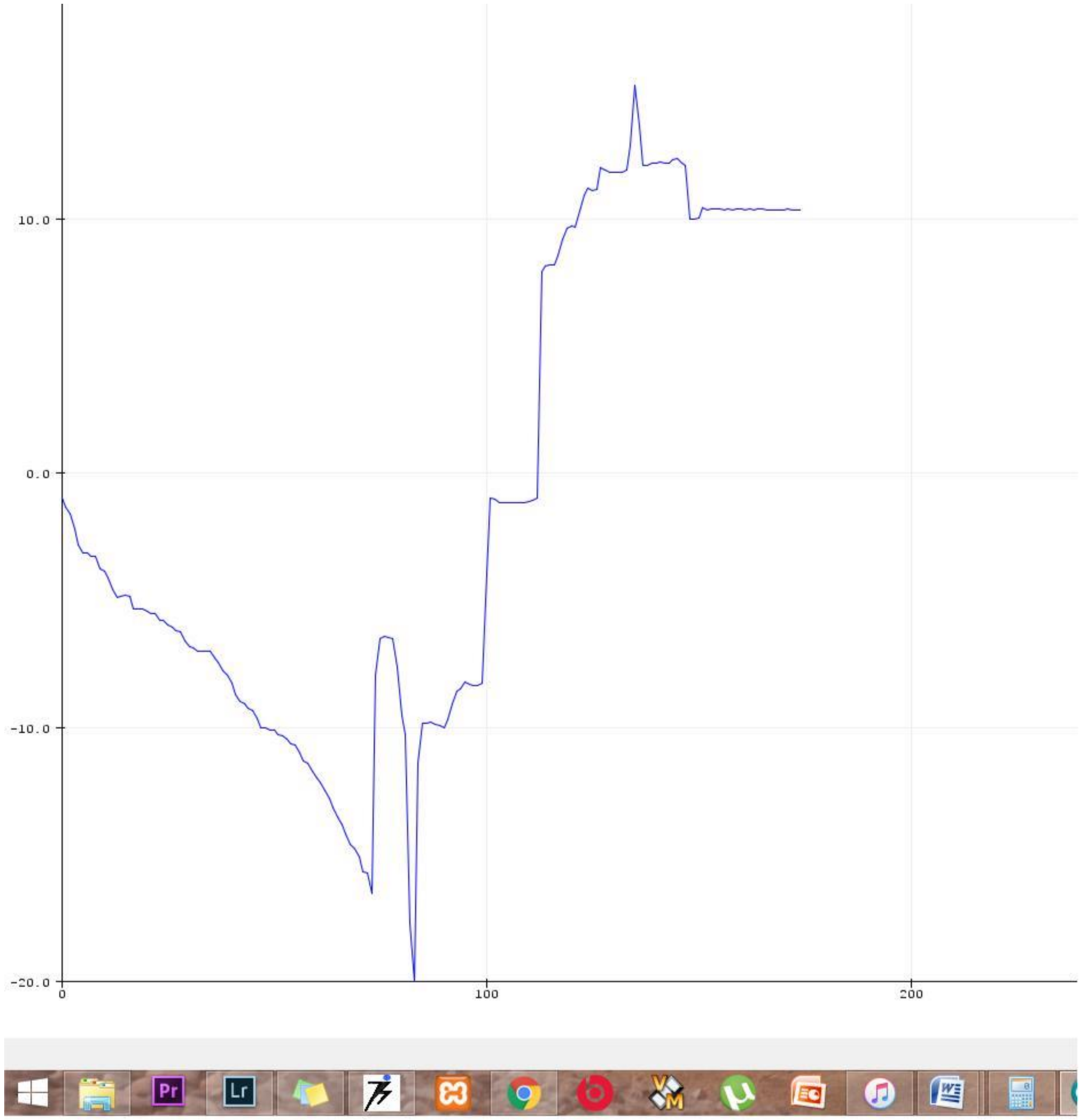
```
Machine OFF
Machine ON
-2.11 amps
-2.89 amps
-4.38 amps
-6.80 amps
-8.32 amps
-10.47 amps
-12.30 amps
-14.06 amps
-15.47 amps
Critical level of current reached
-17.11 amps
Critical level of current reached
-7.97 amps
-4.77 amps
-1.84 amps
Machine OFF
 Used for 4.00seconds
Machine ON
+1.68 amps
+4.06 amps
+7.50 amps
+9.73 amps
+13.24 amps
+15.98 amps
Critical level of current reached
+19.96 amps
Critical level of current reached
+18.32 amps
Critical level of current reached
```

TEST SUBJECT 3:

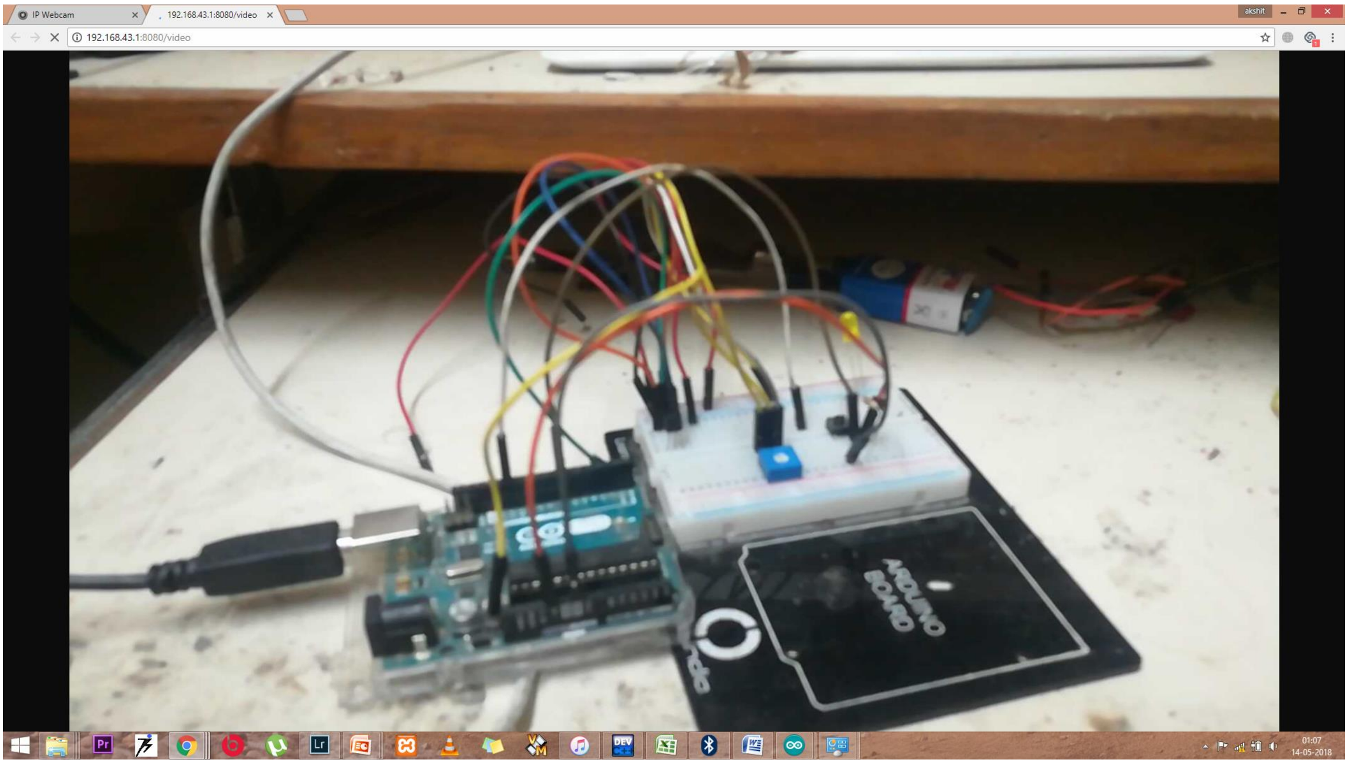


```
Machine OFF
Machine ON
-1.29 amps
-2.97 amps
-5.55 amps
-7.89 amps
-11.68 amps
-14.53 amps
-17.62 amps
Critical level of current reached
-13.44 amps
-8.01 amps
-5.47 amps
-12.23 amps
-19.18 amps
Critical level of current reached
-15.98 amps
Critical level of current reached
-8.05 amps
-6.05 amps
-5.04 amps
-3.55 amps
-1.91 amps
Machine OFF
 Used for 15.50seconds
Machine ON
+1.72 amps
+3.36 amps
+6.21 amps
+10.51 amps
+6.13 amps
+1.60 amps
Machine OFF
 Used for 3.50seconds
Machine ON
-2.58 amps
-2.46 amps
+5.35 amps
+9.41 amps
+7.30 amps
+3.16 amps
Machine OFF
 Used for 3.50seconds
Machine ON
-4.02 amps
-3.98 amps
-3.83 amps
-3.28 amps
-1.13 amps
Machine OFF
 Used for 3.00seconds
Machine ON
+1.72 amps
+3.44 amps
+4.41 amps
+7.30 amps
```

GRAPH :



Graph1: Showing current and thresholds



Screenshot From the ip camera

CHAPTER 5
CONCLUSIONS

The conclusion of implementing SCADA systems using IOT regarding the project is automation and to allow an organization whether large scale or small to carefully and systematically analyze and acquire and anticipate the optimal response to a pre gauged conditions and execute those responses automatically from a single controller unit every time, using the feasibility of internet of things, relying on precise machine control for monitoring equipment and processes virtually eliminating human error.

There has ever been a demand ‘smart’ systems has ever since ever seen an exponential rise and now it is more than ever since the arrival of modern simple circuits and open source programs and the availability of the internet. Getting any "THING" connected that can be connected is more like a norm now. Imagine walking up to the gym machine when you enter the gym and requiring no human interaction you know what your workout for the day is going to be and at the same time your gym owner has obligation to interfere with your personal workout and he can easily monitor and maintain his machine's performance and security using mere sensors and actuators that are so cheap in today's world, blessings of the Moore's law. The machine just notified your gym owner who is using the machine and provides him with a live coverage of your workout, and is already planning your next workout regime and suggesting subsequent diets. The machine might also monitor your heart rate and give you better stats for your training perhaps. Virtually talking and thinking devices might ease the transition to happen, when traditional SCADA will migrate to IoT SCADA. Sharing many characteristics with the traditional SCADA with IoT like data access, manipulation and visualization. What IoT has more for SCADA is in its interoperability, scalability and its vast analytic capabilities with the availability of pr-existing network infrastructures, better sensors/actuators modules, vast arrays of open source platforms traditional SCADA systems have a lot more to offer to the small enterprises as once it did to the large grid enterprises. In a traditional SCADA system individual sensors communicate with their respective back-end applications using proprietary protocols. A cloud-based IoT SCADA systems can collect and manage all flows using open communication standards. This data is exposed through standard APIs and web services. The existence of this middleware layer has enabled the development of business applications and analytics software. As a result the information collected from millions of devices can be computed and analyzed to provide valuable insights and franchises would be just another word in the business dictionary as it can be applied for better business solutions which the modern world still lacks when it comes to rural areas where although internet access has reached but the implementation still lacks a structure. It also offers enhanced security when of an enterprise of a whole system as IoT implications subject it any system to be viable instrument of its system and a global implementation will only help create more of what remains to implemented for IoT to be a global venture.

All in all we can say that such systems when implemented on large or small industrial or enterprises, smart application of these principles can reduce time consumptions of time, effort and money, and can make work much more efficient and easier future.

FUTURE UTILITIES:

Time period	*Architectural style*	*Description*
1970s	Monolithic	Controlled units were on the same site as the controlling computer with hard-wired connections between them (Figure 1).
1980s–1990s	Distributed	SCADA systems networked with devices using special purpose protocols. No external network connection (Figure 2).
2000s	Networked	SCADA systems no longer isolated but connected to external networks, i.e., internet (Figure 3).
Currently	Web-based SCADA	Accessing SCADA components from every where at any time using any web browsers, thin clients, PDA, mobile phone, etc. (Figure 4).
Future	Agent-based SCADA	Using agents and multi-agent systems new architectural style to build scalable, reliable, and flexible agents.

Figure 1 First generation SCADA architecture (monolithic) (see online version for colours)

-\

A web based SCADA is an interesting direction of SCADA architectures systems making use of the internet and hypertext transfer protocol (HTTP) and other web technologies as a communication layer of the system it virtually diminishes a requirement for a dedicated network and also uses development tools, framework, platforms and regular computer languages as development environment for SCADA application thus achieving a more connected , user friendly and reliable systems in the near future as Web-based SCADA system start using the internet to have communication between the remote between the operators' workstations and the MTU's to reduce the cost of the installation of the SCADA network as compared installing and using a dedicated network

Internet browser programs such as Mozilla Firefox, Netscape Navigator or Microsoft Internet Explorer can be used as graphical user interface (GUI) for the operators HMI as this gives all the benefits of a browser-based system, in simplifying the installation process of the client side of the SCADA systems and also enable the users to access the system using wide range of platforms, as browsers are now an intrinsic part of almost all of the modern operating systems and mobile communication is not an unfeasible a thing as it had been a few decades ago. Hence a multi agent monitoring system, although comes with its risks, can help in taking SCADA Systems into their next phase of almost universal implementation taking into its ambit the small enterprises.

OTHER APPLICATIONS:

SCADA in Power Systems:

SCADA is widely used in power distribution systems for applications such as –

Detailed operational planning and control
Resource scheduling(Fuel, etc)
Optimum power flow
Network security and breach detection
Economic dispatch
Generation dispatch control

SCADA in agriculture:

SCADA systems can help farms better manage their crops and fields:

SCADA Field moisture monitoring.
Irrigation managemnet.
Stock estimation
Intruder protection
Pest control.

REFERENCES :

Journals and Articles:

Cloud-Assisted IoT-Based SCADA Systems Security: A Review of the State of the Art and Future Challenges by Anam Sajjid and Haidar Abbas –IEEE.
Electronic ISSN: 2169-3536

IOT based industrial SCADA-International Research Journal of Engineering and Technology by Prof. S. S. Shah , Sanket Raut, Dipak Jagadal, Amar Khatmode,Hajrat Patil
Electronic ISSN: 2395 -0056

The Internet of Energy: Smart Sensor Networks and Big Data Management for Smart Grid – Procidea
Electronic ISSN:2348-3232

Cloud-Assisted IoT-Based SCADA Systems Security: A Review of the State of the Art and Future Challenges by S.K lal, Sudhakar Sharma-IEEE
Electronic ISSN:2327-4662

Research on the architecture and key technology of Internet of Things (IoT) applied on smart grid by Miao yun ,Bu Xin-IEEE
Electronic ISSN:2046-1007

Internet of Things in Industries: A Survey by Xian chin and Koi Lee-IEEE
Electronic ISSN:2233-2243

Research Directions for the Internet of Things by John A Stonvich-IEEE Electronic ISSN:2213-4662

"Internet of Things (IoT): A Literature Review," Journal of Computer and Communications by SomayyaMadakam, R. Ramaswamy, SiddharthTripathi,
Electronic ISSN:2327-4662

World Wide Web:

https://www.researchgate.net/figure/273396385_fig1_Fig-1-Synoptic-view-of-the-paper-structure-reflecting-the-IoT-vision-described-in-the

https://inductiveautomation.com/what-is-scada

http://ieeexplore.ieee.org/abstract/document/6774858/

www.eduscada.com