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Two Way Power Line Communication in Small-Scale Industries

R.Suwetha[1], N.Sushmitha[2], R.Naagine[3], A. Jerrin Simla[4]
[1, 2, 3] Student, Fourth Year, [4]Assistant Professor Department of CSE, Panimalar Institute of Technology, Chennai-600123

Abstract: In the developing small-scale Industries, the machines are designed in such a way that the power is supplied through Power Line Communication (PLC). In order to upgrade the power line communication, it can be modified by transmitting the power and data simultaneously. In existing system, the micro controller is connected to the BMS and EMS by which the demand can be communicated by means of radio link. In order to refrain from radio link transmission, and to simplify the technique we have proposed a two way power line communication system. To transmit power and data simultaneously. The output of the can be viewed by means of a GPRS modem within the industrial environment. This system can be implemented for small-scale industries.
Keywords: Power Line Communication (PLC), BMS, EMS, radio link, GPRS modem, small-scale industries.

I. INTRODUCTION

NOWADAYS, with the growing share of renewable energy sources the least bit scales, electricity is turning into a lively vector additional distinguished than ever. With the event of mobile and autonomous applications, bulk storage of electricity principally through electro chemical devices is turning into more and more advanced. The run potency and autonomy fosters the requirement for smarter, safer and longer lasting batteries, the latter may solely be achieved with additional correct indicators and therefore additional property with the battery itself. The event of a check platform as well as 3 Lithium-ion batteries designed for Electrical Vehicle (EV) applications is more and more advanced. The run potency and autonomy fosters the requirement for smarter chemistry storage may be remotely managed just by voltage observation. Although rugged and low cost, this technology still features allow specific energy and a restricted period of time. On the opposite hand, the assorted Li-ion chemistries primarily utilized in mobile application have an extended lifespan and better specific energy. However, they additionally want associate electronic Battery Management System (BMS) to ensure safe associated reliable operation over associate optimum period an increasing range of indicators area unit therefore computed on the BMS. The State of Charge (SOC) is that the commonest however different studies additionally ask for to predict battery failure or its remaining helpful life a SOC primarily based battery management system has been projected to manage the battery at each grid- connected and is landing operation conditions. The application's Energy Management System (EMS) should react to the current data to adapt battery usage so as to optimize its lifespan whereas meeting the application's power wants. This needs an additional advanced bond between EMS and BMS since energy and data should be changed. Management theme for Energy Storage System (ESS) in micro-grid applications has been projected to increase ESS anticipation and to boost ESS energy potency. For this communication, a fervent physical medium is historically used, which may be extra wires, optical fibbers a communication system. With every of those hardware solutions, varied communication protocols may be enforced. Within the will protocol is employed over a wired network so as to manage associate industrial battery network. These systems use a fervent medium to exchange knowledge and no resolution takes advantage of the DC power link that is inherent in battery steam-powered systems. However, this DC power link itself may be wont to convey data in conjunction with power between the battery and therefore
the energy shoppers. The given resolution permits exchanging data between the EMS and every BMS mistreatment PLC on the DC power bus. This technology is wide utilized in business, particularly in good grid applications and utilizes the
prevailing cable infrastructure to transmit data on the electrical power. A review of existing PLC solutions is delineate for smart-grid applications. The author's affect the variation of PLC to vehicles. Totally different completely different diversifications of indoor PLC area unit projected to attain high turnout suited to different applications like transmission or safety.

II. LITERATURE SURVEY

A. *[1] A review on the key issues for lithium-ion battery management in electric vehicles by L. Lu, X. Han, J. Li, J. Hua, and M. Ouyang in J. Power Sour., vol. 226, pp. 272–288, Mar. 2013*

Compared with alternative normally used batteries, lithium-ion batteries are featured by high energy density, high power density, long service life and environmental friendliness and so have found wide application within the space of shopper physics. However, lithium-ion batteries for vehicles have high capability and huge serial-parallel numbers, which, as well as such issues as safety, durability, uniformity and price, imposes limitations on the wide application of lithium-ion batteries within the vehicle. The slim space during which lithium-ion batteries operate with safety and dependability necessitates the effective management and management of battery management system. This gift paper, through the analysis of literature and together with our sensible expertise, offers a quick introduction to the composition of the battery management system (BMS) and its key problems like battery cell voltage measuring, battery states estimation, battery uniformity and deed, battery fault identification so on, within the hope of providing some inspirations to the planning and analysis of the battery management system. This paper concisely reviews key technology of battery management system in energy unit. The composition of battery management system is analysed. The battery state estimation ways are summarized and compared. The battery uniformity theory and deed ways reviewed. The battery fault identification ways are mentioned.

B. [2] Batteries need electronics by J. Cao and A. Emadi in IEEE Ind. Electron. Mag., vol. 5 Mar. 2011.

Energy-storage systems square measure essential components of the many merchandise from client physical science to advanced electrical drive vehicles. However, battery physical science and management systems square measure required for correct operation of those energy storage systems with batteries. During this article, the BMS functions are bestowed, and therefore the style issues are reviewed. 3 typical applications-cell phones, laptop computer computers, and hybrid EVs-have been explained well. For every application, a typical hardware topology has been explained, followed by a discussion on the corresponding functions and management methods. Cell Phone Applications cellular phone batteries
have considerably modified with the event of cell phones. From the six cells nonparallel, 7.2-V nickel metal (NiCd) battery pack utilized in Motorola DynaTac 8000× to a single-cell three.7-V Li-Po battery utilized in trendy cell phones, battery chemistry has evolved from NiCd, NiMH, and Li particle to Li-Po. once NiCd and NiMH cells square measure used, there's generally no BMS within the battery pack as a result of NiCd and NiMH batteries will be overcharged and over discharged while not being brought into venturous conditions. With the recognition of lithium-based batteries, a lot of safety considerations square measure required to be self-addressed, as metallic element batteries mustn't be overcharged or over discharged. Additionally, a brief circuit or overcharge might cause the battery to burst into flames. Therefore, electric battery protection circuit is important. This is significantly necessary for those cell phones or transportable devices whose battery can be removed or replaced by the users.

C. [3] Battery Management system: An overview of its application in the smart grid and electric vehicles by H. Rahimi-Eichi, U. Ojha, F. Baronti, and M.-Y. Chow in IEEE *Ind. Electron. Mag* Jun. 2013.

The space evolving technology of the good grid and electrical vehicles (EVs), the battery has emerged because the most outstanding energy memory device, attracting a major quantity of attention. The terribly recent discussions concerning the performance of lithium-ion (Li-ion) batteries within the Boeing 787 have confirmed up to now that, whereas battery technology is growing terribly quickly, developing cells with higher power and energy densities, it's equally necessary to boost the performance of the battery management system (BMS) to create the battery a secure, reliable, and efficient answer. The precise characteristics and desires of the good grid and EVs, like deep charge/discharge protection and correct state-of-charge (SOC) and state-of-health (SOH) estimation, intensify the requirement for a lot of economical BMS. The BMS ought to contain correct algorithms to live and estimate the practical standing of the battery and, at identical time, be equipped with progressive mechanisms to guard the battery from risky and inefficient operational conditions. The good grid and EVs square measure 2 samples of growing technologies that will greatly get pleasure from the event of advanced infrastructure and elements. United of the key elements within the good grid and EVs, energy storage has to satisfy many power and energy density criteria supported the characteristics of the appliance. For various applications, together with short-run and long power support, varied kinds of energy storage from flywheels to various battery chemistries square measure utilized

D. [4] Optimal charge equalisation control for series connected batteries by W.-L. Chen and S.-R. Cheng *IET Gener. Transm. Distrib* Aug. 2013.

Batteries play a very important role in property energy systems as a result of the energy hold on in batteries are often sent at any time. Series-connected batteries will furnish a load with higher voltage and consequently scale back the I2R loss throughout power conversion and transmission. However, if unbalanced voltage happens, electric battery with high state of charge (SOC) would react additional drastically than that with lower SOC below each charging and discharging conditions. Unbalanced charge or discharge would make to potential injury to the battery and additionally shorten the battery life cycle. This study presents a changed charge equaliser (CE) beside a best charge levelling algorithmic rule (CEA).

The projected circuit theme will distribute AN unbalanced charge in an exceedingly additional economical method while not increasing extra circuit value.

To any expedite charge levelling among electric battery string, the activated Ce duty magnitude relation is fastened at the higher limits throughout the charge levelling section. A best with a read towards increasing the ultimate battery string voltage is developed to resolve the CE operative sequence and length. The projected levelling strategy is complete employing a peripheral interface controller that uses a buck-boost device because the Ce. The experimental results make sure the performance of the projected strategy.

E. [5] Advancements in OCV measurement and analysis for lithium-ion batteries by M. Petzl and M. A. Danzer in *IEEE Trans. Energy Convers* Sep. 2013.

Incremental open-circuit voltage (OCV) curves and low-current charge/discharge voltage profiles of a lithium-ion (Li-ion) battery area unit compared and evaluated for optimizing measure time and determination. Since these curves area unit usually used for any analysis, minimizing kinetic contributions is crucial for approximating battery OCV behaviour.

During this context, associate progressive OCV measure is characterised by state of charge (SOC) intervals and relaxation times. Varied constant low C-rates, SOC intervals, and relaxation times area unit tested for approximating OCV behaviour. Differential capability and voltage analysis is employed to see whether or not the most conductor options may be resolved satisfactorily. Associate interpolation technique yields extra information points for the differential analysis of progressive OCV curves. It's shown that progressive OCV measurements area unit appropriate for associate approximation of battery OCV behaviour, instead of low current-voltage profiles. What is more, extrapolation of voltage relaxation allows the estimation of absolutely relaxed OCV.

F. [6] Energy management for lifetime extension of energy storage system in micro-grid applications by D. Tran and A. M. Khambadkone in *IEEE Trans. Smart Grid* Sep. 2013.

Energy storage is required in micro-grid to assist solve the matter of irregularity introduced by renewable energy sources, enhance power quality and improve controllability of power flow. This paper presents associate degree energy manager for energy storage system (ESS) in micro-grids. The objectives of the energy manager square measure targeted on rising the energy potency and increasing the lifetime of ESS whereas making certain constraints of energy storage modules square measure complied with. To the current finish a wise native prediction and native planning algorithmic program is planned. Electric battery period model that uses the planned Peaker period energy outturn supported the work of the battery is developed. Verification shows that within the long haul, the energy container will improve overall energy potency of ESS from seventy four.1% to 85.5%, and improve calculable period of two Battery Packs in ESS from three.6 years and a pair of.4 years to five years and 5.7 years severally.

G. [7] Power line communication technologies for smart grid applications: A review of advances and challenges by M. Yigit, V. C. Gungor, G. Tuna, M. Rangoussi, and E. Fadel in *Comput. Netw Sep*. 2014.

This Standard specifies Physical (PHY) and Media Access Control (MAC) layers of the medium frequency band (less than 12 MHz) broadband power line communication technology for smart grid applications (SGPLC) based on Orthogonal Frequency Division Multiplexing (OFDM). The Standard addresses the necessary security requirements that assure communication privacy and allow use for mission critical and security sensitive services and applications.

This Standard also defines the approach that is geared towards achieving an extended communication range with medium speeds in comparison with the existing 8 power line communication technologies operating in similar frequency bands. This Standard specifies Physical (PHY) and Media Access Control (MAC) layers of the medium frequency band (less than 15 MHz) broadband powerline communication technology for smart grid applications (SGPLC) based on Orthogonal Frequency Division Multiplexing (OFDM).The Standard addresses the necessary security requirements that assure communication privacy and allow use for mission critical and security sensitive services and applications. This Standard also defines the approach that is geared towards achieving an extended communication range in comparison with the existing power line communication technologies operating in similar frequency bands.

H. [8] What is about future high speed power line communication systems for in-vehicles networks by F. Nouvel and P. Tanguy in *Proc. 7th Int. Conf. Inf. Commun. Signal Process. (ICICS)*, Macau, China, 2009.

This paper deals with alternative automotive networks involved by the X-by-wire and X-attainment applications. New market demands like navigation, multimedia, security, safety and individualized options introduce more and more electronic control units. Furthermore, the automotive industry has to face a great challenge in its transition from mechanical engineering towards mechatronic products. In the last decades, the power line technology has received an increasing attention and spans several applications both in indoor, outdoor and in vehicle data communications. To fulfil these demands of intra car communications, techniques based on power line communication (PLC) seem to be a good candidate. These techniques offer both high data rate and good adequacy with power line properties. This paper revisits the work carried out in using PLC within the automotive domain. Different solutions are discussed and results are given for different applications.

I. [9] Battery Management Systems for Large Lithium-Ion Battery Packs by A. Davide in Boston, MA, USA: Artech, 2010.

This timely book provides you with a solid understanding of battery management systems (BMS) in large Li-Ion battery packs, describing the important technical challenges in this field and exploring the most effective solutions. You find in-depth discussions on BMS topologies, functions, and complexities, helping you determine which permutation is right for your application. Packed with numerous graphics, tables, and images, the book explains the whys and how's of Li-Ion BMS design, installation, configuration and troubleshooting. This hands-on resource includes an unbiased description and comparison of all the off-the-shelf Li-Ion BMSs available today. Moreover, it explains how using the correct one for a given application can help to get a Li-Ion pack up and running in little time at low cost.

J. [10] The five modes of heat generation in a Li-ion cell under discharge by R. Srinivasan, A. C. Baisden, B. G. Carkhuff, and M. H. Butler in *J. Power Surces* Sep. 2014.

A lithium-ion cell under discharge generates thermal energy (Q) through five different internal parameters or modes: the electrolyte resistance (R-s), anode resistance (R-a), cathode resistance (R-c), and entropy changes in the cathode (Delta S-c), and the anode (Delta S-a). This work demonstrates a set of tools to measure/quantify the heat generated by each parameter separately during discharge. These five sources are not dependent upon each other; they are dependent on the state of charge and the environmental temperature (T-env). The Q generated by each mode varies with degree of discharge and T-env. R-s generates most of the Q in the -10 degrees C to 40 degrees C range; R-c becomes significant at T-env <20 degrees C. Constant current discharge does not cause a monotonic increase in anode and cathode temperatures (T-a and T-c), due to the direction of change in Delta S-c and Delta S-a. Negative change in Delta S-a for the carbon anode cools it, causing the T-a to level off and even decrease with increased discharge. Delta S-c for lithium manganese oxide cathode is positive at some SoC and negative at others, preventing a monotonic increase in T-c. Measuring the five Qs separately opens the opportunity to study thermal-runaway from the perspective of the anode, cathode and electrolyte.

K. [11] Comparative study of energy-efficient sampling approaches for wireless control networks by J. Ploennigs, V. Vasyutynskyy, and K. Kabitzsch in *IEEE Trans. Ind. Informat.* Aug. 2010.

Wireless sensor and control networks are attractive for many embedded system applications mainly because they don't need wired connections for communication or energy supply. Therefore, energy efficiency is an elementary requirement of devices and concerns not only the hardware and communication protocols, but also the device applications. Adaptive sampling approaches promise to reduce the energy consumption of applications by adapting sampling and message transmissions. Selecting appropriate approaches and parameters is challenging as it strongly influences their performance. Therefore, this paper compares several adaptive sampling approaches in different realistic closed control loop scenarios from building automation, to develop a guideline for approach selection and parameterization.

L. [12] Computer-Aided Design of Microwave Circuits by K. C. Gupta, R. Garg, and R. Chadha Dedham, MA, USA: Artech, 1981.

Microwave circuits and computer-aided design are considered along with aspects of microwave network representation, the characterization of transmission structures, the sensitivities of transmission structures, the characterization of discontinuities, lumped elements in microwave circuits, two-dimensional planar components, models for microwave semiconductor devices, and measurement techniques for modelling. Topics related to analysis are discussed, taking into account an evaluation of circuit performance, the sensitivity analysis of microwave circuits, tolerance analysis, the time domain analysis of microwave circuits, and matrix solution techniques. An introduction to optimization is provided, and direct search optimization methods are described along with gradient methods for optimization. Attention is also given to a microwave circuit analysis program and computer-aided design (CAD) programs for microwave circuits.

M. [13] Intelligent PV module for grid-connected PV systems by E. Roman, R. Alonso, P. Ibanez, S. Elorduizapatarietxe, and D. Goitia in *IEEE Trans. Ind. Electron* Jun. 2006.

Most issues carried out about building integrated photovoltaic (PV) system performance show average losses of about 20%-25% in electricity production. The causes are varied, e.g., mismatching losses, partial shadows, variations in current-voltage (I-V) characteristics of PV modules due to manufacturing processes, differences in the orientations and inclinations of solar surfaces, and temperature effects. These losses can be decreased by means of suitable electronics. This paper presents the intelligent PV module concept, a low-cost high-efficiency dc-dc converter with maximum power point tracking (MPPT) functions, control, and power line communications (PLC). In addition, this paper analyses the alternatives for the architecture of grid-connected PV systems: centralized, string, and modular topologies. The proposed system, i.e., the intelligent PV module, fits within this last group. Its principles of operation, as well as the topology of boost dc-dc converter, are analysed. Besides, a comparison of MPPT methods is performed, which shows the best results for the incremental conductance method. Regarding communications, PLC in every PV module and its feasibility for grid-connected PV plants are considered and analysed in this paper. After developing an intelligent PV module (with dc-dc converter) prototype, its optimal performance has been experimentally confirmed by means of the PV system test platform. This paper describes this powerful tool especially designed to evaluate all kinds of PV systems.

N. [14] Radio-Frequency and Microwave Communication Circuit: Analysis and Design by D. K. Misra in Hoboken, NJ, USA: Wiley, 2001.

The products that drive the wireless communication industry, such as cell phones and pagers, employ circuits that operate at radio and microwave frequencies. Following on from a highly successful first edition, the second edition provides readers with a detailed introduction to RF and microwave circuits. Throughout, examples from real-world devices and engineering problems are used to great effect to illustrate circuit concepts. Takes a top-down approach, describing circuits in the overall context of communication systems. Presents expanded coverage of waveguides and FT mixers. Discusses new areas such as oscillators design and digital communication. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

O. [15] Bus CAN by A. Rachid and F. Collet in *Techniques de l'Ingénieur— Traité d'Informatique Industrielle* Paris, France: Techniques de l'Ingénieur, 2000.

The implementation of a communication bus promotes the modular approach in the design of a computer architecture. In a distributed system, task allocation allows for parallelization and, as a result, facilitates study and reduces development costs. Moreover, once the bus is standardized, we are moving towards universal components that are very cheap in the case of the CAN bus (Controller Area Network)CAN is a real-time serial communication system designed to connect intelligent components as well as sensors and actuators in a machine or process. Originally designed by and for the automotive industry (Robert BOSCH Gmbh, 1983) to meet the needs of internal communication in automobiles: multiplexing of electrical controls, reliability, diagnostics, electromagnetic compatibility, organ controls (suspension, brake, motor control), CAN has quickly established itself in many areas of the industry. This article presents the basic elements of the CAN: characteristics, protocol, specific circuits, and dedicated software. Without being the solution to all industrial communication problems, the CAN bus deserves special attention and becomes essential in many applications because it is well adapted to the needs of flexibility, maintainability, reliability, ease of use, robustness hostile environments, economic profitability.

III. EXIXTING SYSTEM

The existing system consists of a power source (Generator, solar power system, etc.) and in order to store the energy gained we use a storage component which is the power unit. The activities of the each individual battery is managed and coordinated by using an interfacing structure called Battery Management System (BMS). A digital battery management system (BMS) can be used either for safety issues or lifetime improvement, or for both. In order to inhibit the use of dedicated wiring for communicating with these

BMS. This solution is also designed to be directly transmit through power line communication. The response and request can be communicated among them, using wireless radio links.

IV. PROPOSED SYSTEM

In Proposed system the industry machineries can be monitored using power line communication. Existing system only get information about energy level monitoring not using the IOT. Proposed system implement the IOT. The Sensor are place in the device, and it will collect the data about the machine and also measure rotor or rotating part of the machine. This data is sent to the common host or another controller through the power line communication. ARM micro controller gets the information to the receiver. This data will be updated to the web server through the GPRS module.

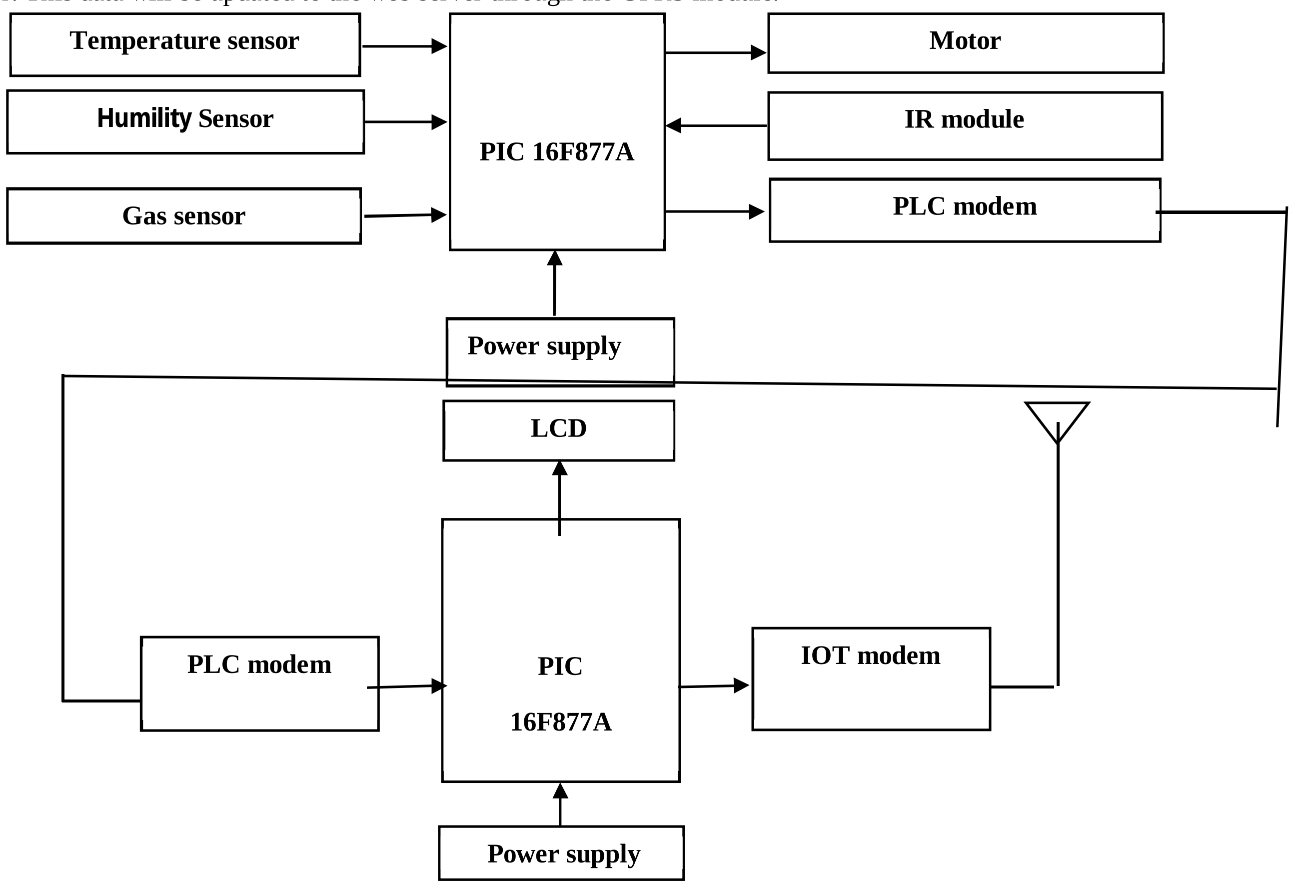

Fig 1. Architecture Diagram

A. Some of the Disadvantages of Existing Approaches are

1) When compared to other communication mediums like routers which will be required in more number in an Industry to cover large areas in acres and to remove Black spots where PLC will provide one stop solution and will limit the cost.
2) There will be no need to implement extra infrastructure as PLC will use existing Powerlines.
3) It provides Flexibility & Stability.
4) It's easy to install.
5) PLC solution is a complementary solution to traditional fixed line networks, wireless networks.
6) Power line communication can be used for many applications like Remote control, Emergency alarms, Security purpose, overall Industrial Automation.

V. MODULES

A. Embedded Sensors

An embedded device network may be a network of embedded computers placed within the physical world that interacts with the surroundings. These embedded computers, or device nodes, ar usually physically tiny, comparatively cheap computers, every with some set of sensors or actuators.

B. Power line communication

Power-line communication (PLC) uses electrical wiring to at the same time carry each information and power. It's additionally referred to as power-line carrier, power-line digital line (PDSL), mains communication, power-line telecommunications, or power-line networking (PLN).

C. Temperature sensor

Thermistors square measure thermally sensitive resistors whose prime perform is to exhibit an oversized, foreseeable and precise modification in ohm resistance once subjected to a corresponding modification in vital sign.

D. Humidity Sensor

A humidness sensing element (or hygrometer) senses, measures and reports each wetness and air temperature. Humidity sensors work by detective work changes that alter electrical currents or temperature within their. There area unit 3 basic forms of humidness sensors: capacities, resistive and thermal.

E. Gas Sensor

A gas detector could be a device that detects the presence of gases in a region, typically as a part of a security system. Therefore this kind of kit is employed to observe a gas leak or alternative emissions and might interface with an effect system so a method may be mechanically stop working. A gas detector will sound associate alarm to operators within the space.

F. DC Motor

A DC motor is any of a category of rotary electrical machines that converts DC electricity into energy. The foremost common sorts think about the forces created by magnetic fields. Nearly every type of DC motors have some internal mechanism, either mechanical device or electronic, to sporadically amendment the direction of current flow partly of the motor.

G. IOT

The Internet of Things (IoT) may be a system of reticular computing devices, mechanical and digital machines, objects, animals or those who square measure supplied with distinctive identifiers and also the ability to transfer knowledge over a network while not requiring human-to-human or human-to-computer interaction.

VI. SCREENSHOTS AND IMAGES

Fig 2. Temperature sensor

Fig 3. Gas sensor

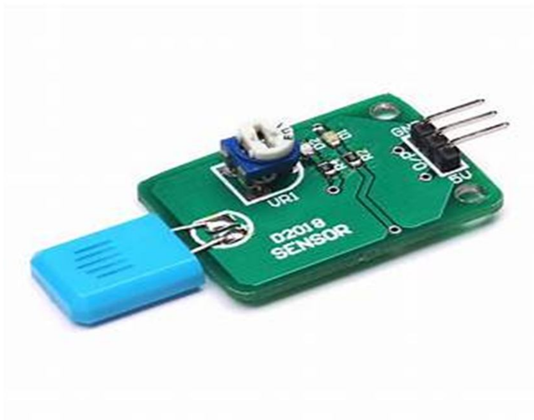

Fig 4. Humidity sensor

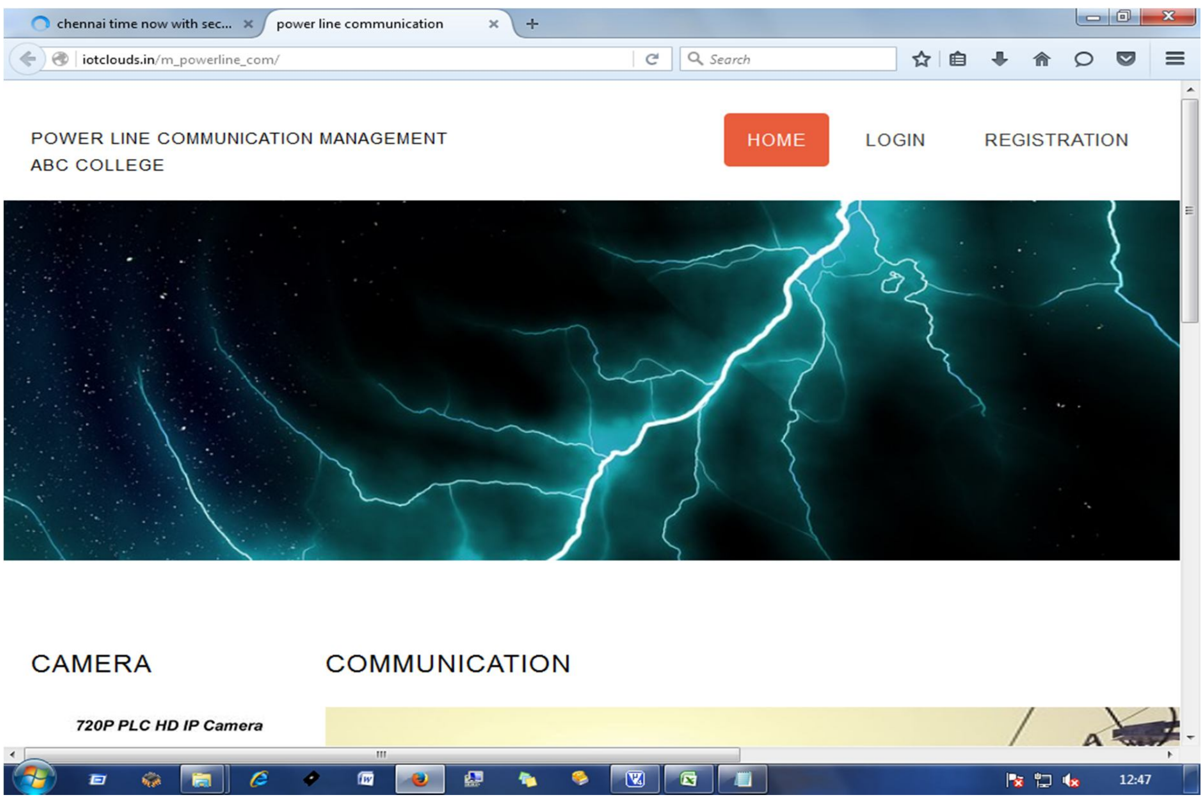

Fig 5. Home screen

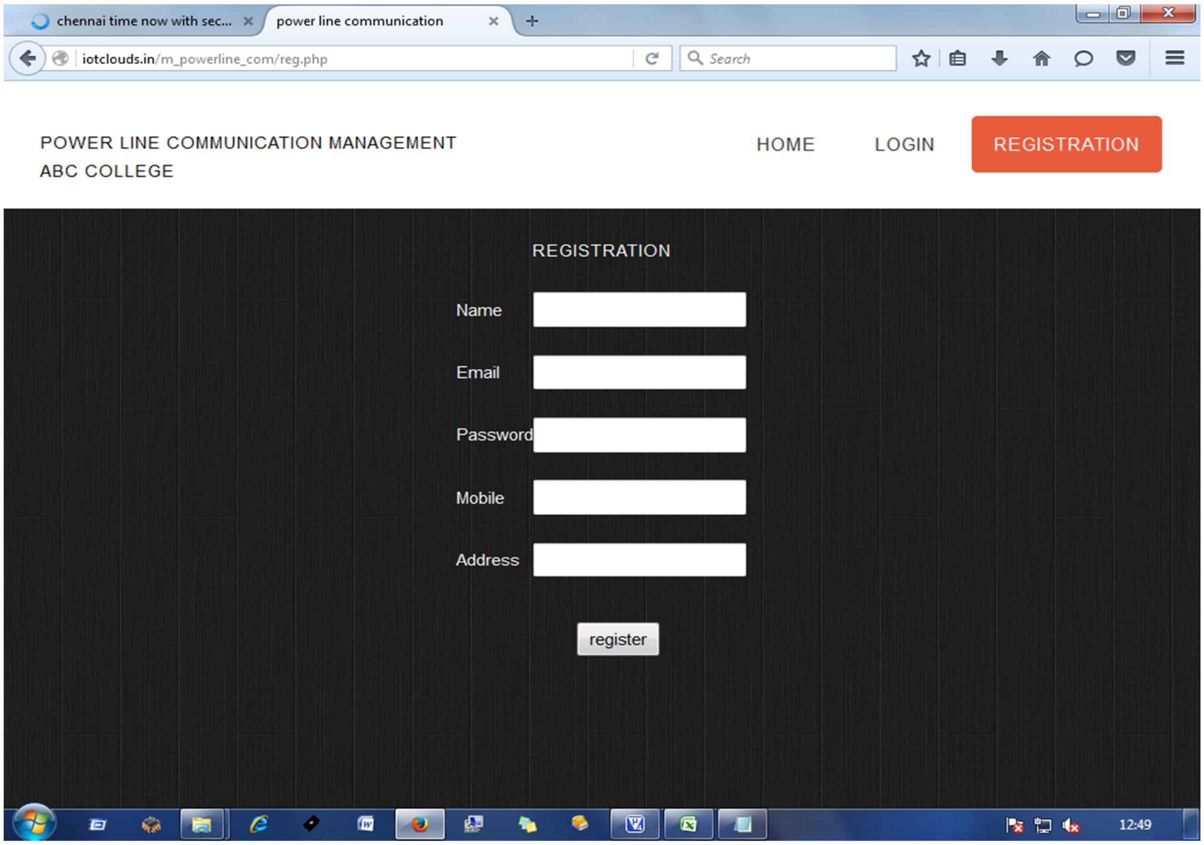

Fig 6. Registration screen

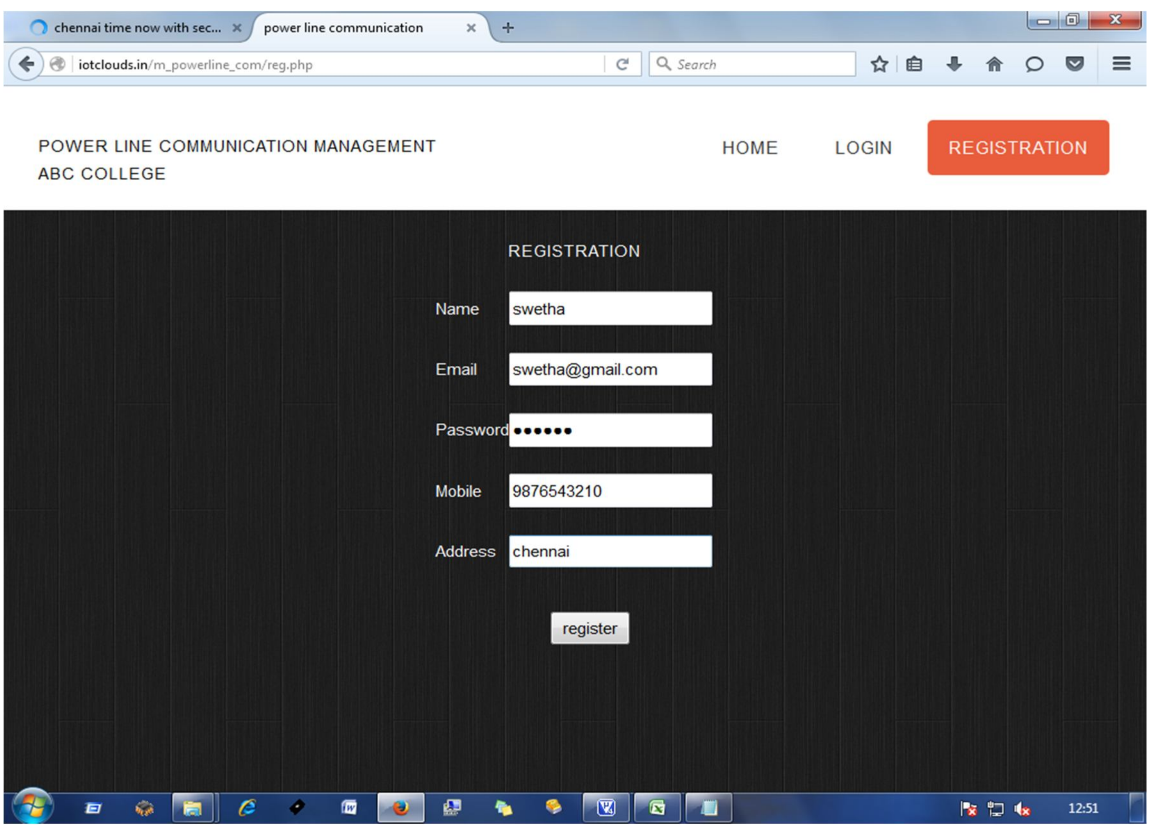

Fig 7. Enter the required details for registration

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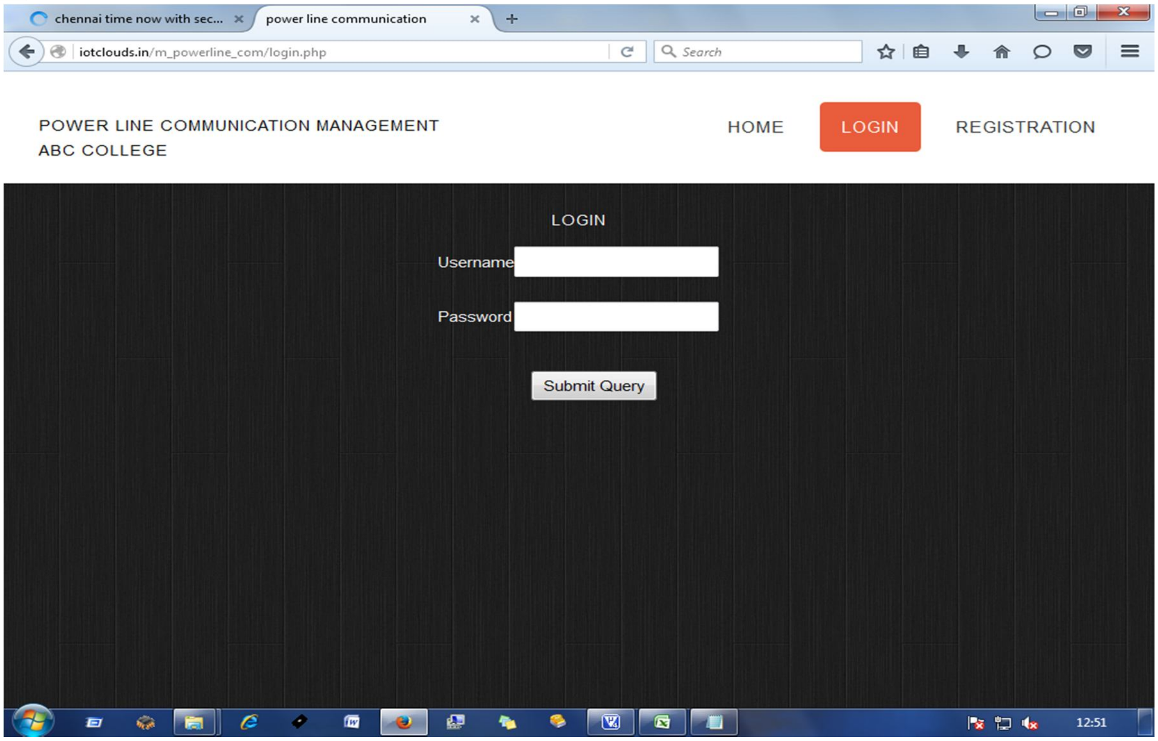

Fig 8. Enter the details for Login

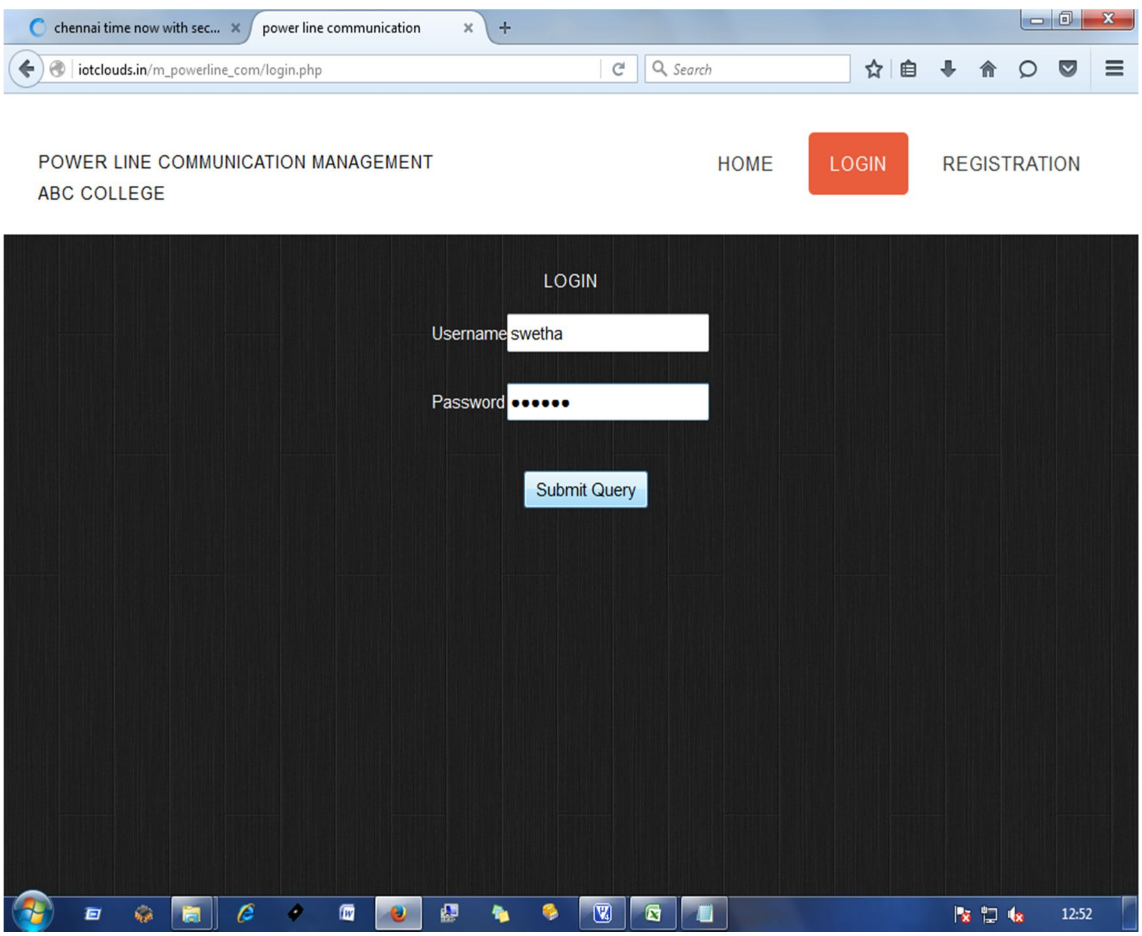

Fig 9. Submit query

VII. CONCLUSION

An innovative solution is presented to communicate in the power line communication by transferring the electricity and data. The proposed PLC solution is designed to take advantage of an existing by two way communication in power line communication. This solution has been developed by IOT for accessing the data within the small-scale industries. Power-line communication (PLC) uses electrical wiring to at the same time carry each information and power. An embedded device network may be a network of embedded computers placed within the physical world that interacts with the surroundings and transfer the required data. IOT is used to communicate and collect the parameters and those data can be accessed anywhere within industrial location this prototyping and experimental validation of the proposed solution.

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