

# **TRANSFORMER HEALTH PROTECTION AND THEFT PREVENTION BY REMOTE MONITORING AND CONTROLLING THROUGH INTERNET OF THINGS (IOT)**

**ROBIN P SAM**

Research Scholar, Department of Electronics, PSG College of Arts and Science,  
Coimbatore-641 014.

**Dr. Sivanandan N**

Assistant Professor, Department of Electronics, PSG College of Arts and Science,  
Coimbatore-641 014.

## **ABSTRACT**

An ongoing tremendous enthusiasm for Machine to Machine correspondence is known as the Internet of Things (IOT), to enable the likelihood for self-ruling gadgets to utilize Internet for trading the information. This work exhibits the plan and execution of continuous checking and over load location of transformer and record key activity indicators of a dispersion transformer for every consumer load voltage utilization progressively. With the assistance of this framework it can limit working endeavors, improve precision, security and productivity in EB department. The sensors are utilized to detect the primary parameters of hardware, for example, voltage and current this detected information is sent to microcontroller and this controller checks parameter limits which further send to the IOT web server programming utilizing IOT Wi-Fi module and GSM modem. By utilizing this information it affirms that the correct data is close by to the administrator and administrator can settle on valuable choices before any catastrophic fault on premise of that information of parameters.

**KEYWORDS:** IOT, GSM, Transformer.

## **1. INTRODUCTION**

The internet of things is tied in with interfacing the detached things. It considers thing to open from the internet that generally has not been. The internet of things can improve personal satisfaction for everybody by exploiting these associated thing and information delivered. The

billions of m2m association make conceivable the everything in IOT. The procedure component use the association between information thing and individuals to convey the correct data. To right thing or individual, at the ideal time, it is these billions of association that include esteem[1-5].

Distribution Transformers have a long life in the event that they are worked under assessed conditions. Be that as it may, their life is basically diminished on the off chance that they are overloaded, bringing about sudden disappointments and loss of stock to a broad number of clients henceforth influencing framework faithful quality. Overloading and inadequate cooling of transformers are the major noteworthy explanations behind disappointment in Distribution transformers. In existing most power organizations utilize Supervisory Control and Data Acquisition (SCADA) framework for electronic checking of power transformers yet intensifying the SCADA framework for web based observing of conveyance transformers is an expensive proposal.

The fundamental issues happen in the current framework are:

- Distribution transformers are starting at now watched physically where a man irregularly visits a transformer site for help and records parameter of noteworthiness. This sort of checking can't give information about coincidental over-load and overheating of transformer oil and windings. All of these factors can basically diminish transformer life.
- Normal transformer estimation framework for the most part identifies a solitary transformer parameter, for instance, control, current, voltage, and stage. While a few different ways could perceive multi-parameter, the hour of securing and activity parameters is excessively long, and testing pace isn't adequately speedy.
- A observing framework can just screen the activity state or make preparations for take the power, and can't screen every single valuable datum of conveyance transformers to diminish costs
- Auspicious discovery information won't be sent to watching focuses in time, which can't pass judgment on dispersion transformers three stage balance.

- Detection framework itself isn't solid. The fundamental standard execution is simply the gadget unsteadiness, poor enemy of sticking ability, low estimation exactness of the information.

The above confinement motivate for a need of appropriation transformer continuous checking framework to identify every single working parameter activity, and send to the observing focus in time. It prompts Online checking of key operational parameters of distribution transformers can give valuable data about the soundness of transformers which will push the utilities to ideally utilize their transformers and keep the benefit in activity for a more extended period. This will likewise help recognize issues before any calamitous disappointment which can bring about a huge cost reserve funds and more noteworthy unwavering quality.

The main objective of this proposed paper is to monitor the current consumed by the single phase CONSUMER LOADS and to prevent it from over loading. LCD screens will be provided in which the consuming current of each consumers and set current for each point will be displayed. Keypads are used to set the threshold limit in means of watts for each consumer individually and to be loaded into the IC. The Input current will be continuously monitored and when any of the parameters goes above the set point level automatically the that particular load will be tripped off so that it ensures that the consumer point will run only at a defined limits. If limit exceeds threshold value the meter get trip and message will send to line man through GSM modem. IOT module is used to indicate EB department of each process through internet regular basis. The threshold limit can alter dynamically by the authorized user based on the situation. The complete system is password protected. The rest of this paper was organized as follows the section 2 briefs about the literature survey, section 3 describes about various methodologies used in this system and finally section 4 concludes the paper with future scope.

## **2. RELATED WORKS**

Kelly et al. (2013) [6] have implemented effectively for monitoring regular domestic conditions using Internet of Thing technology by means of very low cost ubiquitous wireless sensing system. They proposed this technique to provide a flexible connection mechanisms and low -cost solution and for integrating Internet of things with general home monitoring systems.

Mingchuan Zhang et al. (2012) [7] have presented a new concept of Cognitive Internet of Things (CIoT) in their research work. This technology can apperceive current wireless network conditions, analyze the perceived knowledge from the network, and make it intelligent decisions, and perform adaptive actions in the environment, which main aim to maximize network performance. Their cognitive process was based on proposed TNA and made up of TCR and cooperative mechanism. The cooperative mechanism is autonomously triggered and cognitive process autonomic runs when one node cannot fulfill the cognitive assignments. Then game theory was used for analyzing the payoffs of multi-domain cooperation, which illustrates these novel techniques can endows IoT with its intelligence and improve overall systems performance. Finally, they have presented an example application RmCTDS to validate the concept of their new technology CIoT.

Thomas Zachariah et al. (2015) [8] have proposed a general-purpose IoT gateway on smart phones as a software service which provides ubiquitous and universal Internet access to BLE - connected Internet of Things devices. This technique used as an alternative to the narrow, application-specific wireless gateway hampering the development of IoT networks. Their new technique utilizes the smart phone as both a BLE proxy (relaying profile data from the IoT device to the cloud) and an IPv6 router for less resource-constrained endpoints (allowing IoT devices to communicate as IP-connected hosts).

SuwimonVongsingthong and SuchaSmanchat (2014) have presented about the Internet of Things (IoT), an enabler of communication between people and things and also between things. They have discussed about the IoT and it has to overcome huge barriers to gain trust from people, it has also illustrated a specific potential to add a new dimension to the application in healthcare, logistics, transportation, disaster and environment by enabling wireless communication between smart objects. Therefore, always the IoT should be considered as a part of the future generation Internet in which anything and everything can connect in a network where all of the objects can interact with each other. The development of several issues and problems will make the IoT a complete solution for the given application. If Internet of Things has been successfully implemented, the less human efforts will benefit the quality of life as well as business.

Shiu Kumar (2014) [9] has introduced and implemented an internet based smart home system that can be easily controlled remotely upon user authentication. Using the REST ful based web service, the Android based smart home application communicates via internet with the micro

web-server. Any android smart device can be used to install the smart home app and monitor as well as control the home environment. They have developed a low cost smart home system which requires only the microcontroller for all processing. They have used the Google speech recognition engine instead of using an external voice recognition module.

### **3. METHODOLOGIES**

Smart grid, the next generation electric power system is actual way of digital transmission of electricity. It is digital technology that allows resourceful two way communications between utility and customers. Our project designed based upon online monitoring of main operational parameters of transformers can provide useful information about the health of transformers which will help the utilities to optimally use their transformers and keep the asset in operation for a longer Period. This system will help us to identify problems before any objectionable failure, thus resulting in a long life service for transformers. In transformer monitoring system we used current transformers with signal conditioning unit for each consumer lines at Terminal side for monitoring the consumption of each consumer leads to prevent electricity theft. We used power supply to operate microcontroller, IOT and GSM module. Figure 1 shows the connection between microcontroller and all other devices. Sensors sense the data and display it on LCD display at the same time GSM module send the message(data) to EB line man number as per programmed. All details was logged in the server through IOT which acts as full duplex mode to switch ON or OFF the consumer lines remotely if they get any unsecure data about transformer thus we can avoid failure and protect the device.

#### **3.1 BLOCK DIAGRAM**

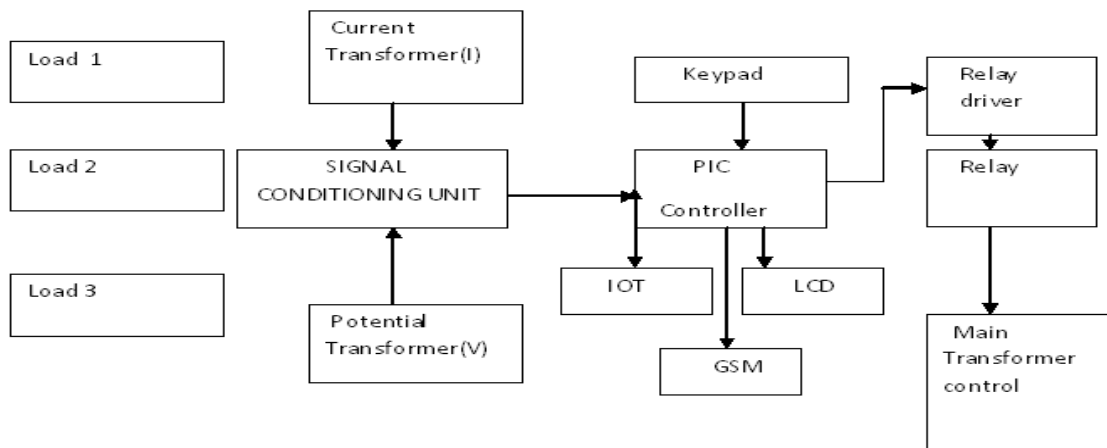
The main power supply will be given to the load through CT and step down transformer. The 230 volt AC supply will be Step down to 12v by using step down transformer this 12V AC supply will be converted in DC by using bridge rectifier and it will be regulate up to 5V by using 7805 regulator for working of microcontroller. The overall block diagram for proposed model is shown in Figure 1.

Capacitor filters are used to remove any ripples present in the DC voltage. The current flowing through the load is sensed by CT and output of CT is analog form. It will be given to

ADC pin of PIC 16F877A microcontroller for converting analog to digital form. The current sense the load current according to preset inbuilt value in the microcontroller, if the current sense is less than preset inbuilt value no operation takes place, if we increase the load, if the current drawn is more than threshold value relay will be trip particular load. LCD ought to be utilized to demonstrate the genuine status of three unique loads.

IOT framework is utilized interface between the trip status and consumers. The message will be given to the interfacing media as indicated by coding framework and to line man through GSM modem. The microcontroller is modified in implanted C language in MP LAB programming. A LCD interfacing system is additionally utilized in microcontroller. On the off chance that any anomalies happen it will be shown on LCD. The AC supply to the load is subsequently cut off from the load and the load is tripped. When the circuit is stumbled it must be reset for further use utilizing reset switch. In either case, the microcontroller is modified in order to demonstrate the status of the yield on the LCD interfaced to it.

In case of normal operation microcontroller pin will receive 5v dc from regulator and accordingly displays the status on the LCD. In case of any abnormalities, the microcontroller pin doesn't receive the 5V input signal and the related status is accordingly displayed on the LCD.



**FIGURE 1: OVERALL BLOCK DIAGRAM**

### 3.2 PIC MICROCONTROLLER

The microcontroller that has been utilized for this task is from PIC family. PIC microcontroller is the primary RISC based microcontroller manufactured in CMOS (complimentary metal oxide semiconductor) that utilizes separate transport for guidance and information permitting concurrent access of program and information memory. The primary favorable position of CMOS and RISC mix is low control utilization bringing about an exceptionally little chip size with a little stick check. The primary advantage of CMOS is that it has immunity to noise than other creation methods.

Different microcontrollers offer various types of memories. EEPROM, EPROM, FLASH and so on are a portion of the memories of which FLASH is the most as of late created. Innovation that is utilized in PIC16F877A is flash innovation, with the goal that information is held notwithstanding when the power is turned off. Simple Programming and Erasing are different highlights of PIC 16F877A.

#### PIN DIAGRAM OF PIC 16F877

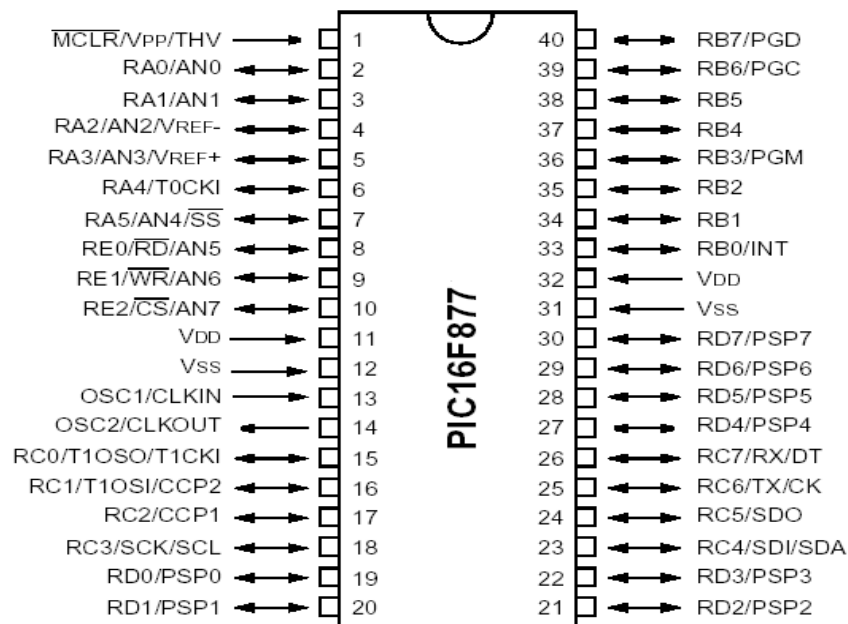


FIGURE 2: PIC 16F877 ARCHITECTURE

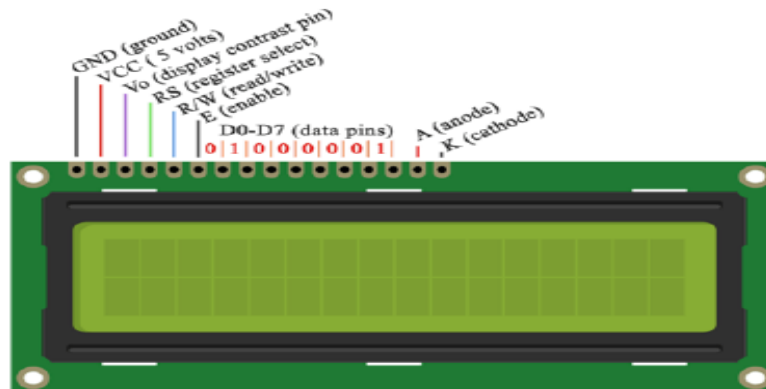
### 3.3 16x2 LCD

It has  $(16 \times 2 = 32)$  32 characters in total and each character is made of  $5 \times 8$ -pixel dots.

Specifications of 16x2 LCD are:

- Built-in controller (ST7066 or Equivalent)
- +5V power supply only
- Negative voltage optional for +3V power supply
- 1/16 duty cycle
- White LED backlight not available
- Interface: 6800, option SPI/I2C (RW1063 IC)

It is used to display condition of overload as per this we can take necessary action.



**FIGURE 3: 16x2 LCD**

### 3.4 CURRENT TRANSFORMER

This transformer is intended to screen the inventory current. The inventory current that needs to screen is step down around the current transformer. The step down current is changed over by the voltage with the assistance of shunt resistor. At that point the changed over voltage is redressed by the precision rectifier. The precision rectifier is a setup gotten with an operational amplifier so as to have a circuit acting like a perfect diode or rectifier.



### **3.5 VOLTAGE SENSOR**

The voltage sensor which will be using will given the voltage consumption of the load. Voltage sensors are employed to the consumed voltage. In our project we will be employing a step down voltage transformer of range, 10 v. The output of these voltage sensors will be given to the appropriate rectifier circuit to convert ac to dc. Since the voltage output will contain some dc components after rectification we will employ a simple filter circuit and the signal will be fed into the analog to digital control channels of the microcontroller.

### **3.6 SHUNT RESISTOR**

A shunt can likewise be utilized to quantify current. For this situation a resistor of precisely known resistance, the shunt, is put in series with the goal that all the current to be estimated will course through it. Since the resistance is known, by estimating the voltage drop crosswise over it, one can calculate the current streaming. All together not to disturb the circuit, the resistance of the shunt is ordinarily extremely little. Shunts are evaluated by maximum current and voltage drop at that current, for instance, a 500 A/50 mV shunt would have a maximum suitable current of 500 amps and at that current the voltage drop would be 50 millivolts. By default, most shunts are intended to drop 50 mV when working at their full appraised current and most "ammeters" are really planned as voltmeters that arrive at full-scale redirection at 50 mV.

On the off chance that the current being estimated is likewise at a high voltage potential this voltage will be available in the fenced in area containing the perusing instrument. Once in a while, the shunt is embedded in the arrival leg (low voltage side) to evade this issue. Another arrangement is to utilize a Hall Effect (non-contact) current sensor rather than a shunt.

### **3.7 PRECISION RECTIFIER**

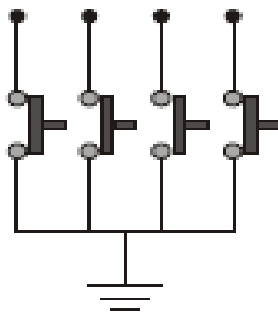
The full wave rectifier is the blend of half wave precision rectifier and adding amplifier. At the point when the input voltage is negative, there is a negative voltage on the diode, as well, so it works like an open circuit, there is no current in the load and the output voltage is zero. At the point when the input is certain, it is intensified by the operational amplifier and it turns the diode on. There is current in the load and because of the feedback,, the output voltage is equivalent to the input.

### 3.8 RELAY OPERATION

A relay is an electrically worked switch. Current moving through the coil of the relay makes an attractive field which pulls in a switch and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are twofold toss (changeover) switches. Relays enable one circuit to switch a second circuit which can be totally independent from the first. For instance a low voltage battery circuit can utilize a relay to switch a 230V AC mains circuit. There is no electrical association inside the relay between the two circuits; the connection is attractive and mechanical. Here the relays are utilized to turn ON or OFF the consumer line dependent on the direction from the microcontroller.

### 3.9 KEYPAD

In the least complex case, a switch has two bits of metal considered contacts that touch to make a circuit, and separate to break the circuit. The contact material is picked for its protection from consumption, in light of the fact that most metals structure protecting oxides that would keep the change from working. Contact materials are additionally picked based on electrical conductivity, hardness (resistance to abrasive wear), and mechanical quality, ease and low toxicity. Sometimes the contacts are plated with honorable metals. They might be intended to wipe against one another to clean up any sullyng. Nonmetallic conductors, for example, conductive plastic, are now and then utilized. Here in this framework 4 keypad is utilized for entering secret password and to set threshold limit for every consumer.

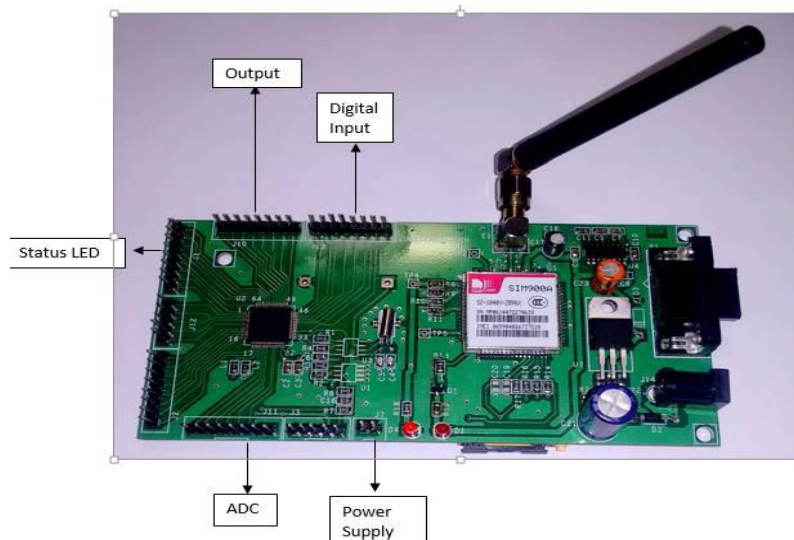


**FIGURE 4: KEY CIRCUIT**

### 3.10 IoT-INTERNET OF THINGS

The Internet of Things (IoT) is a domain wherein articles, creatures or individuals are given one of a kind identifiers and the capacity to move information over a system without expecting human-to-human or human-to-PC collaboration. IoT has developed from the intermingling of remote innovations, micro-electromechanical systems (MEMS) and the Internet. The idea may likewise be alluded to as the Internet of Everything. A thing, in the Internet of Things, can be an individual with a heart screen embed, a homestead creature with a biochip transponder, a vehicle that has worked in sensors to alarm the driver when tire weight is low - or some other regular or man-made item that can be doled out an IP address and gave the capacity to move information over a system. Lumisense IoT board intended to meet an assortment of online application needs with unmistakable points of interest that empower the inserted framework creator to effectively, rapidly and consistently add internet availability to their applications.

The module's UART update highlight and website page control make them ideal for online remote applications, for example, biomedical checking, natural sensors, and information's from compact battery worked remote sensor organize gadgets. Lumisense IoT board included with SIM900 GPRS modem to actuate internet association additionally outfitted with a controller to process all input UART information's to GPRS based online information.



**FIGURE 5: IOT MODULE**

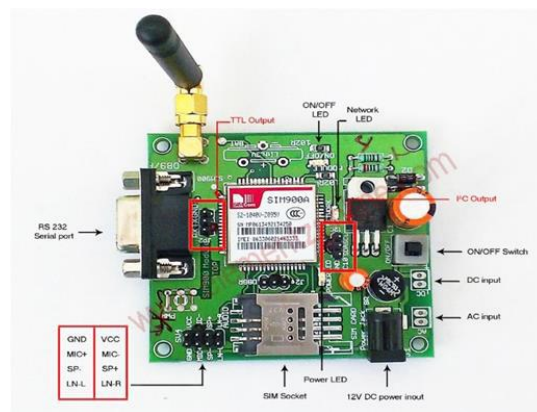
### 3.11 GSM Module

GSM module need 12V, 2A supply for its proper functioning. It can be used for SMS, voice, data, fax with low power consumption. It delivers GSM/GPRS 900/1800MHz Performance. PIC microcontroller sends actual load value to authority by using GSM.

Few more features of the GSM are:

- Tri-Band GSM: 900/1800/1900MHz or Quad-Band GSM: 850/900/1800/1900MHz
- GPRS multi-slot: class 10/8
- GPRS mobile station: class B
- Control via AT commands (GSM 07.07, 07.05)

In this system GSM is used to send load current values at the secondary of the transformer to EB line man in case of any over load occurs.



**FIGURE 6: GSM module SIM900A**

## 4. CONCLUSION

An IOT based transformer monitoring framework for power transformer was planned, actualized and tried. It is very helpful when contrasted with manual observing and furthermore it is dependable as it is beyond the realm of imagination to expect to screen consistently the load voltage and load current physically. A server module can be added to this framework to occasionally get and store transformer parameters data pretty much all the consumers usage in a

web server application. In the wake of getting message on any variation from the norm we can make quick move to counteract any cataclysmic disappointments of intensity transformers. We need not need to check all power and current transformers and comparing stage currents and voltages and therefore we can recuperate the framework in less time and blames before any dubious disappointments in this way bringing about huge cost sparing just as improving framework dependability. This framework would wipe out the necessity of human power and along these lines giving proficiency and exactness. This model will give precise subtleties of vitality burglary. It will oversee detecting the parameters and furthermore record subtleties for power burglary. This paper will likewise guarantee the wellbeing and help in decline in robbery level and would not bring about any mischief to nature and environment. In future the parameters like oil level, oil temperature rise, ambient temperature rise, and so on can be included this framework.

#### **REFERENCES:**

- [1] M. T. Lazarescu, "Design of a WSN platform for long-term environmental monitoring for IoT applications," *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, vol. 3, no. 1, pp. 45–54, 2013.
- [2] K. Gama, L. Touseau, and D. Donsez, "Combining heterogeneous service technologies for building an internet of things middleware," *Computer Communications*, vol. 35, no. 4, pp.405–417, 2012.
- [3] L. Foschini, T. Taleb, A. Corradi, and D. Bottazzi, "M2M-based metropolitan platform for IMS-enabled road traffic management in IoT," *IEEE Communications Magazine*, vol. 49, no. 11, pp. 50–57, 2011.
- [4] A. J. Jara, M. A. Zamora, and A. F. G. Skarmeta, "An internet of things-based personal device for diabetes therapy management in ambient assisted living (AAL)," *Personal and Ubiquitous Computing*, vol. 15, no. 4, pp. 431–440, 2011.
- [5] S. Tozlu, M. Senel, W. Mao, and A. Keshavarzian, "Wi-Fi enabled sensors for internet of things: a practical approach," *IEEE Communications Magazine*, vol. 50, no. 6, pp. 134–143, 2012.

[6] S.D.T. Kelly, N.K. Suryadevara and S.C. Mukhopadhyay, "Towards the Implementation of IoT for Environmental Condition Monitoring in Homes", Sensors Journal, IEEE(Volume:13 , Issue: 10 ),October 2013.

[7] Mingchuan Zhang, Haixia Zhao, Ruijuan Zheng, Qingtao Wu and Wangyang Wei, "Cognitive Internet of Things: Concepts and Application Example", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 6, No 3, November 2012, ISSN (Online): 1694-0814.

[8] Thomas Zachariah, Noah Klugman, Bradford Campbell, Joshua Adkins, Neal Jackson, and Prabal Dutta, "The Internet of Things Has a Gateway Problem" , HotMobile'15, February 12–13, 2015, Santa Fe, New Mexico, USA. ACM 978-1-4503-3391-7/15/02 <http://dx.doi.org/10.1145/2699343.2699344>.

[9] Shiu Kumar, "UBIQUITOUS SMART HOME SYSTEM USING ANDROID APPLICATION", International Journal of Computer Networks & Communications (IJCNC) Vol.6, No.1, January 2014.