# ULTRA LOW POWER WIRELESS SENSOR NETWORK FOR HOME AUTOMATION

## Kowsalya.K[1]  Nandhini.M[2]  Subhalakshmi.G[3]  Rahul.A M.E[4].,

[1] Department of ECE, Sengunthar Engineering College, Tiruchengode,(INDIA)

[2] Department of ECE, Sengunthar Engineering College, Tiruchengode,(INDIA)

[3] Department of ECE, Sengunthar Engineering College, Tiruchengode,(INDIA)

[4] Assistant Professor, Department of ECE, Sengunthar Engineering College, Tiruchengode,(INDIA)

## ABSTRACT

*This paper presents a low cost flexible and reliable home automation system with additional security using ARDUINO microcontroller, with IP connectivity through local Wi-Fi for accessing and controlling devices by authorized user remotely using Smart phone application. The proposed system is server independent and uses Internet of things to control human desired appliances starting from industrial machine to consumer goods. The user can also use different devices for controlling by the help of web-browser, smart phone or IR remote module. To demonstrate the effectiveness and feasibility of this system, in this paper we present a home automation system using atmega328 microcontroller and esp8266-01 as a connectivity module. It helps the user to control various appliances such as light, fan, TV and can take decision based on the feedback of sensors remotely. We have tested our system through conducted experiment on various environmental conditions.*

## I .     INTRODUCTION

As rapid change in technology always aims to serve the mankind, the expectation for living a simple yet advance life keeps on increasing Internet has become an important part of human's social life and educational life without which they are just helpless. The Internet of things (IoT) devices not only controls but also monitors the electronic, electrical and various mechanical systems which are used in various types of infrastructures. These devices which are connected to the cloud server are controlled by a single user (also known as admin) which are again transmitted or notified to all the authorized user connected to that network. Various electronics and electrical devices are connected and controlled remotely through different network infrastructures. Web browser present in laptop or smart phone or any other smart technique through which we can operate switches, simply removes the hassle of manually operating a switch. Now a day's although smart switches are available they proves to be very costly, also for their working we required additional devices such as hub or switch .As there is rapid change in

wireless technology several connectivity devices are available in the market which solves the purpose of communicating medium with the device and the micro-controller. Starting from Bluetooth to Wi-Fi, from ZIGBEE to Z-wave and NFC all solve the purpose of communicating medium. RF and ZIGBEE are used to used in most wireless networks. In this project we have taken ESP8266-01 Wi-Fi module which is programmed through ARDUINO UNO to control various devices. The rest of sections in this paper is organized as follows: Section II provides a system overview of the system. The hardware design is explained in Section III, Section IV discusses about the software design and experimental results are discussed in Section V. At the end the paper concludes by looking at the future research and recommendations which are required to make the system more effective.

## II.     LITERATURE SURVEY

Home automation is a challenging one not only to the developer but also to the consumer. Developer has to choose the component as per the customer requirement. Due to all the customer demands are not equal hence they have to compromise with the existing products.

Through detailed study of *"Home Automation Using Internet of Thing" proposed by Shopan Dey, Ayon Roy and Sandip Das, it is found that they have used Raspberry pi module to connect ESP8266-01 module to the internet*. Through this module they are controlling various devices through web page and also through android application

*. K.Venkatesan and Dr. U. Ramachandraiah in their paper have implemented Zigbee module in Arduino* mega through which they are controlling devices. They have used various sensors for various purpose. Also they have provided real time notification, feedback on web-server in which customers can see what is happening in their home . With the help of logic gates, a Raspberry pi, 555 timer and flip-flop also the devices are controlled from web app. Paper proposed *by Shashank Shiva Kumar Jha, Vishwateja Mudiam Reddy, Tapan Pokharna, Naresh Vinay* shows how this is operated and controlled . International Journal of Pure and Applied Mathematics Special Issue

*"Programmable Infrared Accessory Light Switch" by Warsuzarina Mat Jubadi and Normaziah Zulkifli* shows how TV remote is used to control room light and other appliances. Here IR remote and one IR receiver is used and programmed in such a way that it stores the frequency of the existing remote and use them directly to control appliances . So, here we introduce ARDUINO Uno with ESP8266-01 module. This is not only cost-effective but also proves to be the easiest one when it comes in term of programming and also implementation. From, it is observed that Esp8266-01 works on 802.11 b/g/n protocol whereas ZIGBEE uses 802.14.5 protocol. ZIGBEE consumes least power as 3mW whereas Wi-Fi and Bluetooth consumes nearly 100mW. But if we compare speed of Esp8266 has maximum speed up to 11mbps but ZIGBEE has only 250kbps. Clearly esp8266 defeat ZIGBEE and Bluetooth not only in cost but also in speed YFC is giving a brief idea about the interconnection of microcontroller , peripheral devices as well as sensors and what is the architecture behind it.

## III. ARCHITECTURE AND FRAMEWORK
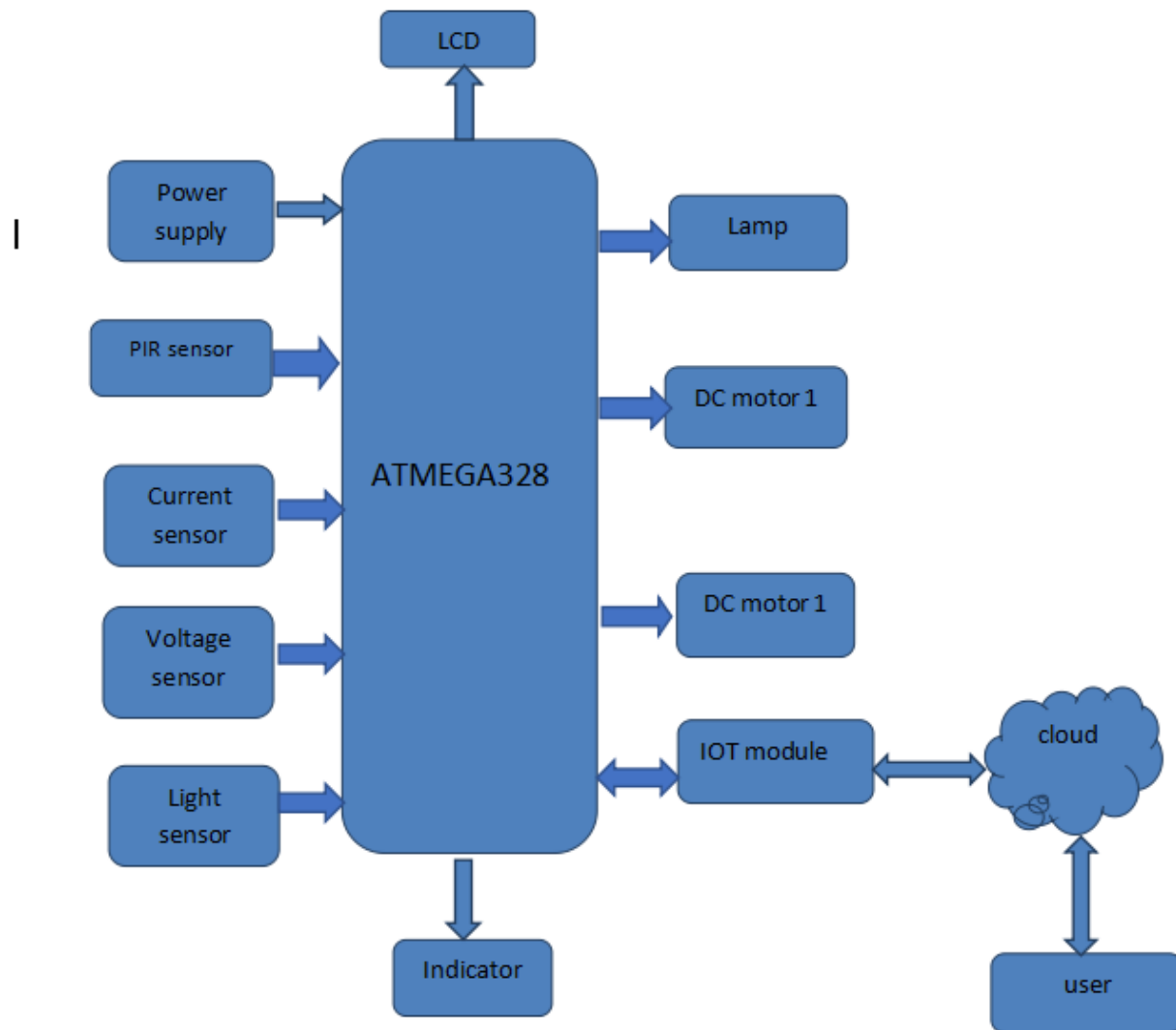


## IV. PROPOSED TECHNOLOGY

In the proposed system, the combination of Wi-Fi and ZIGBEE are also proposed for power saving another solution embeds several radio modules to reduce energy consumption and latency for neighbour discovery and opportunistic networking, but at the expense of increasing both the size and cost of device. Nevertheless, the use of Wi-Fi, Bluetooth and ZIGBEE as a low power radio is still too costly for WSN applications. Bluetooth low energy (BLE) protocol reduce power consumption and provides connection to smart phones with easy setup but has limited operating range and is subject to royalties, which makes BLE unsuitable for WSN ubiquitous low-cost devices. The

proposed system also monitor and displays the range of the voltage which has been used by the electric and electronic equipments. This system uses the Arduino 328 controller.

## V.    SYSTEM SPECIFICATION

### ARDUINO

 **Arduino** is an open source computer hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (**shields**) or Breadboards (other circuits on them).

**Arduino Uno** is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

 **"Uno"** means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. (IDE = integrated development environment

## C   LANGUAGE

C is widely used for systems programming in implementing operating systems and embedded system applications, because C code, when written for portability, can be used for most purposes, yet when needed, system-specific code can be used to access specific hardware addresses and to perform type punning to match externally imposed interface requirements, with a low run-time demand on system resources. C can also be used for website programming using CGI as a "gateway" for information between the Web application, the server, and the browser. C is often chosen over interpreted languages because of its speed, stability, and near-universal availability. One consequence of C's wide availability and efficiency is that compilers, libraries and interpreters of other programming languages are often implemented in C.

The reference implementations of Python, Perl and PHP, for example, are all written in C. Because the layer of abstraction is thin and the overhead is low, C enables programmers to create efficient implementations of algorithms and data structures, useful for computationally intense programs. For example, the GNU Multiple Precision Arithmetic Library, the GNU Scientific Library, Mathematics, and MATLAB are completely or partially written in C. C is sometimes used as an intermediate language by implementations of other languages. This approach may be used for portability or convenience; by using C as an intermediate language, additional machine-specific code generators are not necessary.

C has some features, such as line-number preprocessor directives and optional superfluous commas at the end of initialize lists that support compilation of generated code. However, some of C's shortcomings have prompted the development of other C-based languages specifically designed for use as intermediate languages, such as C++. C has also been widely used to implement end-user applications. However, such applications can also be written in newer, higher-level languages.

## VI.      CONCLUSION

In this paper we focused on different process of operating or controlling electrical and electronic appliances remotely with the help of Arduino. This method of controlling such applications is referred to as automation. The experimental setup which we designed has its focal point on controlling different home appliances providing 100% efficiency. Due to advancement in technology, Wi-Fi network is easily available in all places like home, Office Building and Industrial Building so proposed wireless network easily controlled using any Wi-Fi network. The wiring cost is reduced. Since less wiring is required for the switches. This also eliminates power consumption inside the building when the loads were in off conditions. This system is also platform independent allowing any web browser in any platform to connect ESP8266-01. The system is fully functional through android application known as "ESP8266 Wi-Fi control". The delay to turn ON is 3 sec and turn OFF is 2 sec for any load. For future use, the researchers would recommend as (i)Reducing the time delay to turn on and off of an appliance (ii) Adding speech recognition to the system (iii)using automatic smart phone detection through Wi-Fi such that it will operate the loads automatically when it is in range. (iv) Expansion of range of Wi-Fi such that one can operate in permissible long distance through smart phone.

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