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# Electricity monitoring and supervision using Power sensor tag

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**Abstract—**

*There has many technologies are present to controlling the AC loads like FAN, LIGHT etc. such as controlling through mobile phone , controlling through smart phones and controlling through remote. Internet of things is very popular now a days, we can control the AC Loads and also monitoring the AC Loads by using Internet Of Things. In this project I've used internet of things for monitoring purpose and controlling has done by mobile technology. In detail GSM com GPRS connected to the ARM7 processor and Loads are connected at out of the ARM7. When we send a character 'A' to the ARM7 processor through GSM it is automatically switch ON the LOAD1 and the correspondent current ratings are uploaded to Thing Speak via GPRS. Likewise when a character 'B' sent to the ARM7 through GSM LOAD1 has OFF and current ratings uploaded to the Thing Speak. Initially we have to recharge for some amount for electricity. When current charges exceeds your amount it has intimate you via GSM and if you want to recharge more money so you can send a message like $500 to GSM then it has add your money automatically. And '?' for knowing the available balance. Characters 'A', 'B', 'C', 'D' for switch ON and OFF of LOAD1 and LOAD2 respectively. By using Thing Speak we can monitor the current ratings.*

***Keywords*—** Embedded C; ARM Processor; Web Data; and Internet of Things; and Python API

## I. INTRODUCTION

Now-a-days, controlling and monitoring plays a main role in our day to day life. Everything we can control using advanced technologies and we can also monitoring the things we need. Now we can control and monitor anywhere using Internet of things. If you have Internet in your PC/Mobile you can direct upload the data you need and control it from internet itself. When we talking about the Internet of things.

The **Internet of Things** (**IoT**) is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices. Each thing is Uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

Thing Speak is an open source Internet of Things application and API to store and retrieve data from things using HTTP over the internet or via a local area network. With think speak, you can create sensor logging applications, and social network of things with status updates.

In addition storing and retrieving numeric and alphanumeric data, the ThingSpeak API allows for numeric data processing such as time scaling, averaging, median, summing, and rounding. Each ThingSpeak channel supports data entries of up to 8 data fields, latitude, longitude, elevation, and status. The channel feeds support JSON, XML, and CSV formats for integration into applications.

The ThingSpeak application also features time zone management, read/write API key management and JavaScript-based from Highslide software

In this proposed solution, mainly three sensors are the key elements which collect the data from surrounding and upload it to webserver . End user will monitor it from a simple customized web page with a login. And those three sensors are Soil Moisture sensor and Soil Conductivity sensor interfaced with ARM processor at analog port. Python API is used in the laptop for sending the data captured by the laptop's serial port into the web server.

## II. SYSTEM ARCHITECTURE

The system architecture of this proposed system is divided into two different blocks.

*ARM7 END:* Hardware implementation for this proposed system is shown below with the simple blocks. Power Supply block is designed and developed to generate power source for the ARM processor and its relevant components. Reset Circuit is designed and developed to reset the program whenever necessary and interfaced to the ARM processor for greater st able response. Clock Circuit is designed and developed to generate oscillations and interfaced to the ARM processor for needy response. LCD Display can also interface to the ARM processor for displaying the status of the system for better understanding. A simple block diagram shown below:

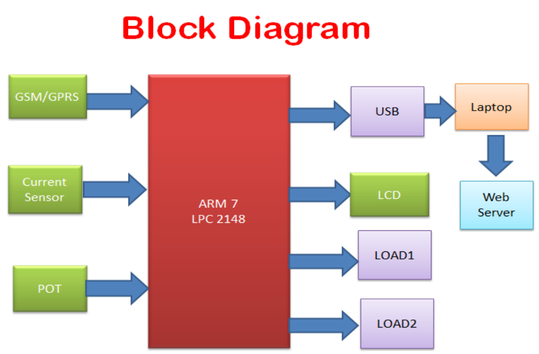


Figure – 1: Block Diagram

*SERVER END:* A WEB SERVER is designed and developed for collecting the data from surroundings through Sensors and upload it in to web server. Manual UI is designed for understanding of process with the help of HTML and PYTHON. Using the concept of Internet of Things we are uploading the each individual sensor values to the web server, there I can monitor the sensor values.

## III. IMPLEMENTATION

*HARDWARE:*

In hardware implementation, ARM processor plays a key role in monitoring and controlling the security system. Low-power consumption ARM processor (LPC2148) operating at 3.3V, 50uA is designed and mounted on a PCB along with Reset Circuit and a Clock Circuit. LPC2148, a 32-bit microcontroller with advanced RISC architecture and having 48 GPIO lines with a program memory of 32KB and a data memory of 512Bytes.

And we have 2 UART ports i.e. UART0 and UART1. In this project GSM/GPRS connected to the UART0 port of ARM7 (LPC 2148). And 1 Analog to Digital channels, though I connected one Analog sensor to ADC channels of ARM7, so that it converts Analog Values to Digital Values. Those values i have uploaded into Thing Speak.

ARM7 (LPC 2148) internal architecture overview has shown below as well ARM7 (LPC 2148) with LCD has shown below.

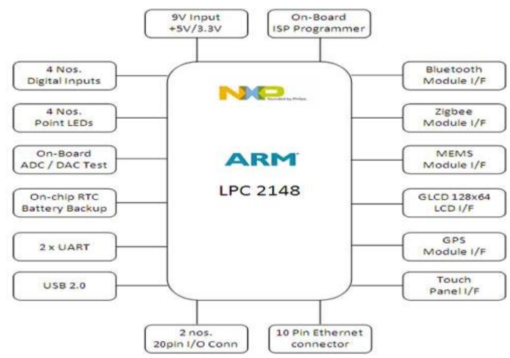


Figure – 2: ARM Overview [LPC2148]

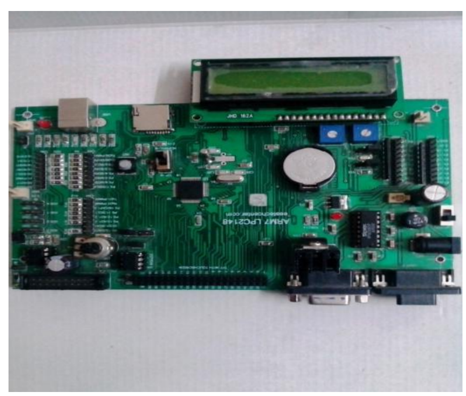

Figure – 3: LPC2148 Development Board

*Current Sensor:*The Allegro™ ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switchmode power supplies, and overcurrent fault protection. The device is not intended

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for automotive applications. The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging. The output of the device has a positive slope (>VIOUT(Q)) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss. The thickness of the copper conductor allows survival of the device at up to 5× overcurrent conditions. The terminals of the conductive path are electrically isolated from the signal leads (pins 5 through 8). This allows the ACS712 to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.

Current sensor Device has shown below:

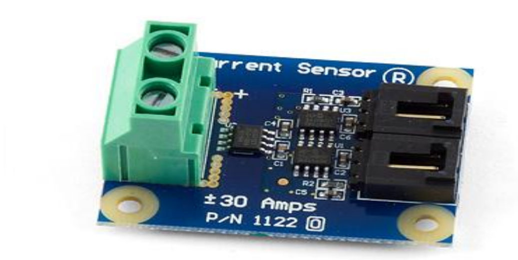



Figure – 4: Current Sensor

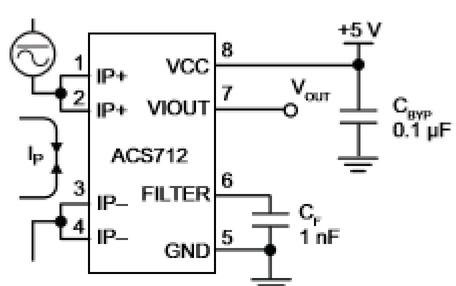
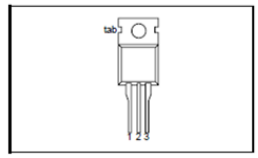



Figure – 5: Current sensor PIN description

*TRIAC BT136 And MOC3021:*Glass passivized, sensitive gate TRIACS in a plastic envelope, intended for use in general purpose bidirectional switching and phase control applications, where high voltages sensitivity is required in all four quadrants.

Pin description of TRIAC BT136 has shown below:

PIN CONFIGURATION




| PIN | DESCRIPTION |
|---|---|
| 1 | main terminal 1 |
| 2 | main terminal 2 |
| 3 | gate |
| tab | main terminal 2 |

Fig – 6: TRIAC BT136 Pin Description

Current and voltage driven at TRIAC has shown below:

Quick Reference Data

| SYMBOL | PARAMETER | MAX. | MAX. | MAX. | UNIT |
|---|---|---|---|---|---|
| | BT136- | 500E | 600E | 800E | |
| $V_{DRM}$ | Repetitive peak off-state voltages | 500 | 600 | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | 4 | 4 | 4 | A |
| $I_{TSM}$ | Non-repetitive peak on-state current | 25 | 25 | 25 | A |

Fig – 7: BT136 Voltage and current analysis

When coming to MOC3021, The MOC301XM and MOC302XM series are optically isolated triac driver devices. These devices consist of gallium arsenide infrared emitting diodes, optically coupled to silicon bilateral switch and are designed for applications requiring isolated triac triggering, low–current isolated ac switching, high electrical isolation (to 7500 VAC peak), high detector standoff voltage, small size, and low cost. This series is designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115/240V AC operations.

Below is the description for PIN and its schematic:


Fig – 8: MOC Schematic

*GSM/GPRS:* GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services.GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service). Mobile telephony standards have given below:

| Standard | Generation | Frequency band | Throughput | |
|---|---|---|---|---|
| GSM | 2G | Allows transfer of voice or low-volume digital data. | 9.6 kbps | 9.6 kbps |
| GPRS | 2.5G | Allows transfer of voice or moderate-volume digital data. | 21.4-171.2 kbps | 48 kbps |
| EDGE | 2.75G | Allows simultaneous transfer of voice and digital data. | 43.2-345.6 kbps | 171 kbps |
| UMTS | 3G | Allows simultaneous transfer of voice and high-speed digital data. | 0.144-2 Mbps | 384 kbps |

Fig – 9: Mobile Telephony standards

GSM com GPRS device has shown below:

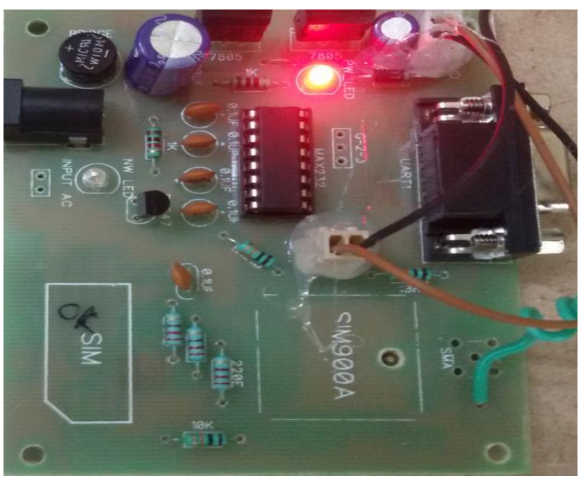



Fig – 10: GSM/GPRS Module

With the help of GSM/GPRS, I have control the LOADS as well I have monitor them.
Connections of GSM have shown in Schematic Section.

Final Schematic Diagram of this Project has shown below:

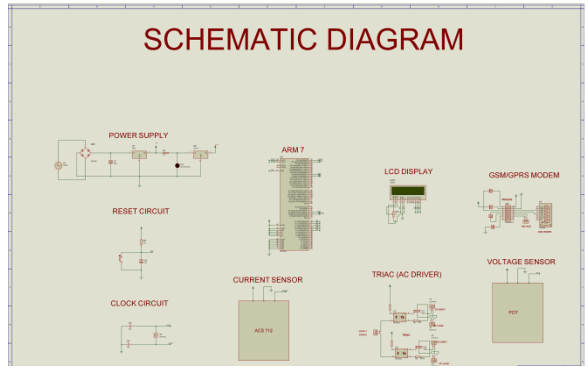



Figure – 11: Schematic Diagram

Current sensor (ACS 712) connected at P0.29 of ARM7 (LPC 2148), GSM/GPRS connected to UART1 of ARM7. Reset Circuit and Clock Circuits were interfaced at RST, XTAL1, and XTAL2 of LPC2148.

*SOFTWARE:*

Here, to program ARM processor KeiluVision 4 was used as a cross-compiler and Flash Magic was used as a programmer. ThingSpeak is an open source Internet of Things application and API to store and retrieve data from things using HTTP over the internet or via a local area network.

## IV. ALGORITHM & FLOWCHART

*ALGORITHM:*

Step – 1: Initialize ARM, LCD, ADC and GSM.

Step – 2: Wait until you see WELCOME on LCD.

Step – 3: Read the ADC values of current sensor.

Step – 4: If voltage values are greater than max threshold then switch off the LOADs and send an SMS to the Owner.

Step – 5: If voltage values are greater than min threshold then switch off the LOADs and send an SMS to the Owner.

Step – 6: If the voltages values are normal then read the SMS that comes from GSM

Step – 7: If a character ‘A’ receives then LOAD1 should ON.

Step – 8: If a character ‘B’ receives then LOAD1 should OFF.

Step – 9: If a character ‘C’ receives then LOAD2 should ON

Step – 10: If a character ‘D’ receives then LOAD2 should OFF.

Step – 11: UART port must be Open while sending the sensor values from processor to ThingSpeak.

Step – 12: Now login to ThingSpeak and Create channel and fields.

Step – 13: Now open the Python Program and run main.py, when sensor values changed then you can see the graph of sensors.

Step – 14: If a character ‘?’ receives then it gives you available balance in your wallet and it uploads the current ratings to Thing Speak as well.

*FLOWCHART:*

The flowchart of this paper is shown below.

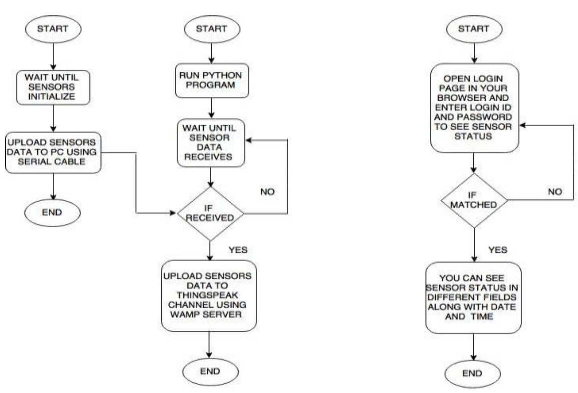
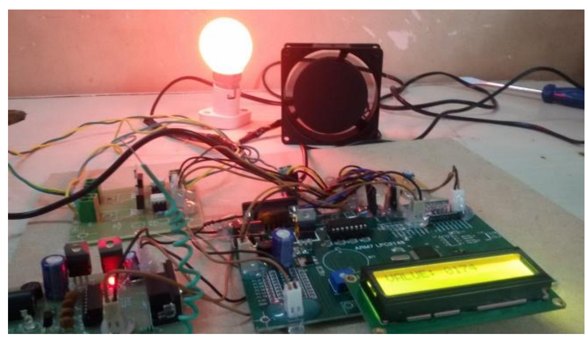



Figure – 12: Flow Chart

## V. RESULTS


Fig – 13: Final Prototype 1


Fig – 14: Final Prototype 2



Final – 15: Final Prototype 3


Fig – 16: Final Prototype 4

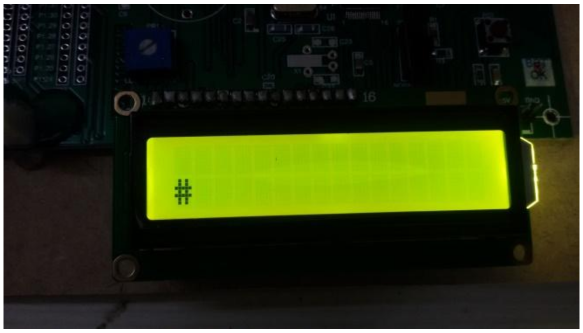



Fig – 17: Final Prototype 5

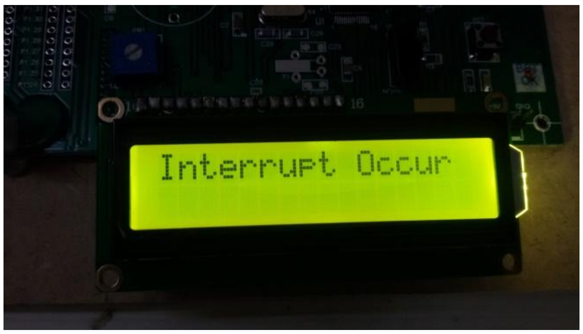



Fig – 18: Final Prototype 6


Fig – 19: Final Prototype 7


Fig – 20: Final Prototype 8

Fig – 21 Final Prototype 9

## VI. CONCLUSION

Here Power Sensor Tag, a wireless sensor node communicated with the help of GPRS and GSM is designed and developed. Smart power meters are rocking the market by the end of 2020 and the tag which we proposed here is the commercial prototype of the power meter. The power response is uploaded to the web server through GPRS. A web server is also developed to store and log the data.

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*And, secondly i would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame*

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Assot Prof S Arvind Kumar B.TECH from JNTU Hyderabad and M.TECH in ES & VLSI Design from OU Hyderabad. He has Six years of teaching experience and he is presently working as ASSOCIATE PROFESSOR in MLRITM dundigal, Hyderabad

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