IJARST
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science & Technology (IJARST)
Volume 2, Issue 3, June 2020

IoT Gateway Using A9G Module and Cloud Computing

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Abstract: *Everything is going to be connected to the Internet and data will be used for various purposes, creating not only information from it, but also, wisdom and knowledge. Internet of Things (IoT) is becoming important to mix with cloud computing because of the amount of data IoT's can generate with resource utilization and storage capacity of cloud computing. Main advantage of cloud computing is that you can access it from anywhere any time on your fingertips. This feature makes cloud computing much more flexible for user. In industry there are some sensors for specific work for example proximity sensor for detection of object, in agriculture we can use soil moisture sensor for moisture measurement etc. So for every activity it needs a separate circuit and software implementation and including these circuits as they are not fully automatic, still we have to do some kind of functions manually. So all this activity takes more time and still it is not fully automatic. So solution for making it fully automatic to control it via cloud, to use and control it from anywhere at any time, we can use A9g module, as it provides cloud support. A9g have more interface support like ADC, RS485, 4-20MA, Relay, Analog interface so with the help of this interface we can use same setup for different applications with less modifications so that there is no need to use application-based circuitry.*

Keywords: A9g module, Eagle, Sensor Interfaces

1. INTRODUCTION

Today, Iot application development demand is extremely high. So IoT could be a major technology by which we are able to produce various useful internet applications. Basically, IoT could be a network during which all physical objects are connected to the net through network devices or routers and exchange data. Internet of Things (IoT) is far more trending now. With the trend occurring, in near future, number of connected devices would be many times larger than the amount of individuals connected. Productive work goes on during this area of next generation Internet.

CLOUD COMPUTING:

Cloud Computing provides computing services like servers, storage, databases, networking, software, analytics, intelligence, and more, over the Cloud (Internet). Cloud Computing provides an alternative to the on-premises data centre. Cloud Computing is an working technology during which Pc/smart phones/tablet users can store, calculate, arrange, manage, host, create, publish, delete, share, edit and manipulate remotely hosted system software and applications software's, Data & Information by using the Internet. With this cloud computing, a mobile phone can become an interface to large data centre. Sharing great deal of media content is another feature that cloud computing provides. Sharing great deal of media content is another feature that cloud computing provides [1].

A9G MODULE:

A9G is complete quad-band GSM/GPRS module. It also has GPS. It is having mixture of GPRS and GOS/BDS technology and integrates it in very small compact Surface mount device package, saving customers time and money in developing GNSS applications. The A9G are utilized during an excellent range of IoT applications and is good for

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Internet of things applications for home automation, industrial wireless control, wearable electronics, wireless location sensing devices, wireless location system signals and other IoT applications. A9G Surface mount device package from the standard SMT equipment to understand very rapid production of products, especially for automation, large-scale, low-cost modern production methods for the convenience of different types of Internet of Things hardware terminal applications.

IoT GATEWAY:

An Internet of things (IoT) gateway provides the bridge between IoT devices within the field, the cloud, and user equipment like smart phones. The IoT gateway provides a communication link between the sector and also the cloud and can be provide offline services and real-time control of devices within the field[2].To gain sustainable interoperability within the Internet of things ecosystem, 2 dominant architectures used for data exchange protocols: bus-based and broker-based. Protocols that support information exchange between interoperable domains are classified as message-centric or data-centric interconnected devices communicate using lightweight protocols that do not require extensive CPU resources. C, Java, Python and a few scripting languages are the popular choices of IoT application developers. IoT nodes use separate IoT gateways to control protocol conversion, database storage or deciding (e.g. collision handling), so as to supplement the low intelligence of devices. A much more number of manufacturers are involved in IoT gateway design and production. Communication Protocol: Here we have used Message Queuing Telemetry Transport MQTT protocol for communication purpose. It is used to communicate cloud to a9g module. A9g send the sensor data to the cloud then with the help of mobile phone we can monitor or send some instruction back to a9g module [5]

II. LITERATURE SURVEY

[1] Mohammad Aazam Pham Phuoc Hung EuiSmart gateway-based communication for cloud of thingsThis paper basically states that how iot and cloud can be integrated. How it help in better utilization of network and cloud resources. Detailed information of iot and cloud with their types is provided in this paper. [2] Anand Nayyar, Vikram PuriSmart farming: IoT based smart sensors agriculture stick for live temperature and moisture monitoring using Arduino, cloud computing & solar technology. This paper shows how Arduino board is used in agricultural application. This project uses esp 8266 to access or communicate with cloud. In this paper soil moisture, temperature sensor is used. Also for charging purpose they used solar power system. [3] Pavankumar Naik Arun KumbiKirthishreeKatti Nagaraj TelkarAUTOMATION OF IRRIGATION SYSTEM USING IoT This paper speaks about automatic irrigation system with help of Arduino board. They have used sensor like soil moisture, temperature, humidity and motor which is driven by relay. They have provided android support for monitoring the status of each of sensors. [4] André Glória, Francisco, Cercas Nuno Souto Design and implementation of an IoT gateway to create smart environmentsThis paper speaks about how swimming pool can be control by using application of iot. This project uses Arduino board as a main controller. It uses sensor like LDR for pool light, water level sensor for detecting water level inside pool, humidity sensor to measure relative humidity and used a relay to control water motor remotely. [5] Neha Khanna, Gurmohan Singh, D.K. Jain, Manjit Kaur DESIGN AND DEVELOPMENT OF SOIL MOISTURE SENSOR AND RESPONSE MONITORING SYSTEM This paper shows how soil moisture sensor works with detailed study of it, with their types. In This paper soil moisture sensor is interfaced with pic microcontroller. As a result it shows the response of soil moisture sensor depending on values on the sensors. This paper basically shows how soil moisture sensors can be used as response monitoring system. [6] Mohammad Woli Ullah Mohammad Golam Mortuza Md. Humayun Kabir Zia Uddin Ahmed Internet of Things Based Smart Greenhouse: Remote Monitoring and Automatic Control. This paper based on greenhouse. The project controls the temperature, humidity, light and soil moisture level by sensing the values from sensors and controlling heaters/coolers, sprayers, bulbs and water pumps accordingly. It uses atmega328p microcontroller. For communication with internet it uses GSM/GPRS module. [7] S. Kalaivanan* and Sangeetha Manoharan Monitoring and Controlling of Smart Homes using IoT and Low Power Wireless TechnologyThis paper is based on home automation system. They have used zigbee routers which are connected to Arduino. For sending sensor data from zigbee module to internet they have used esp8266 module. They have used sensor like temperature sensor,

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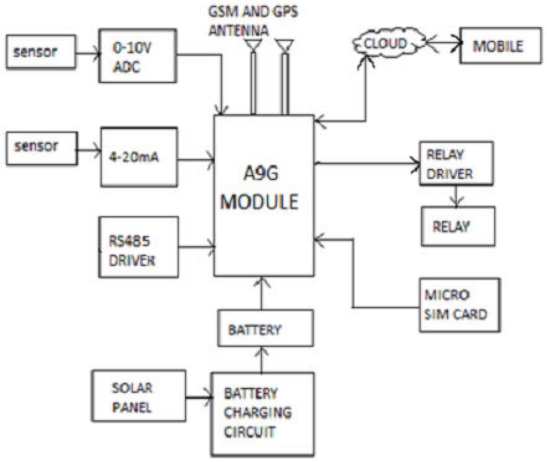
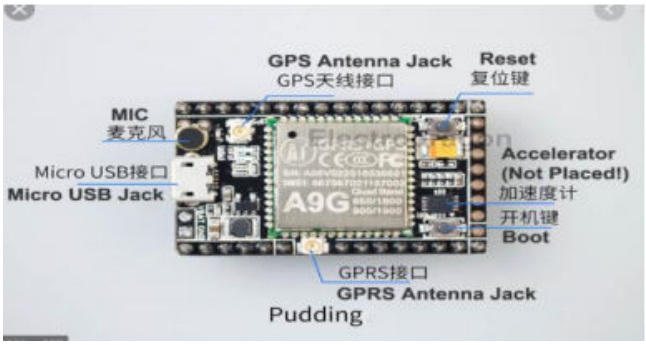
air quality and gas sensor, PIR sensor, humidity sensor, ultrasound sensor, smoke detector, fan control etc. [8] Lalit Mohan Satapathy, Samir Kumar Bastia, Nihar Mohanty Adriano based home automation using Internet of thingsThis paper speaks about how home automation is done using Arduino uno. They have used wifi technology with esp8266 module to create hotspot. Ip connectivity method is used so that only authorised person can access it. They have sensor for fan, light, room heater, TV, gas etc. This entire sensor is operated through relay module. [9] Mihai Bogdan Computer Science and Electrical Engineering Department, Lucian Blaga University of Sibiu, 550025, Romania, Temperature and Humidity Measurement System This paper shows how temperature and humidity sensor is used to maintain the required temperature for industrial applications. Both the sensors are interfaced with Arduino board which is open source hardware. This paper gives detailed information of temperature sensor and humidity sensor with their interfacing diagrams. [10] Aman Kumar, Ajit Kumar, Praveen Kumar Sharma Smart Irrigation System using IoT:SIS This paper tell us about smart irrigation system using Arduino board. They have used HTTP protocol. For iot purpose they used bolt module. It consists of Wi-Fi with micro SD card port. They used sensors like soil moisture, rain sensor and motor driven by relay.

III. BLOCK DIAGRAM & DESCRIPTION



A. A9G Development Board



The A9G development board is a multi-functional development board depends on A9G GPRS / GSM + GPS / BDS module that can be used to verify the essential communication functions and peripheral functions of the A9G module.A9G development board with the essential phone / SMS, GPRS networking communications, GPS / BDS dual-mode positioning.A9G development board have a lithium battery charging management support, microphone, speaker interface, USB communication interface, multiple user keys / led, TF card slot, acceleration sensor, SPI interface, I2C2 interface, ADC interface. It even have an external 30W / 200W camera on A9G development board camera expansion board, also having an external conventional slot machines on A9G development board slot machine expansion board.

ISSN (Online) 2581-9429

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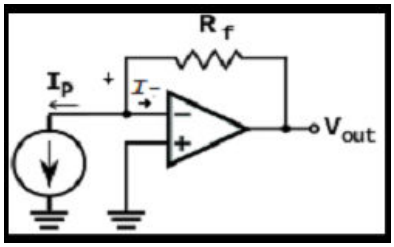
B. 4 to 20 mA (I to V Converter)

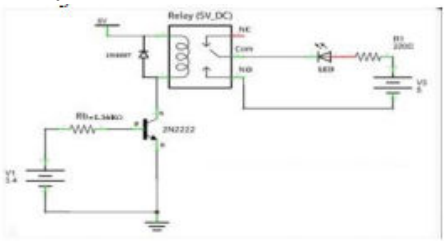


We will assume that a 0 to 4.2 Vdc input will be used to measure 4 to 20 mA. Ohms law says: R=V/I here V is the Voltage, I is the current and R is the resistance R=4.2V/0.020A = 210Ω.When 20 mA flows through a 210Ω resistor, it will drop 4.2volts. When 4 mA current flows through a 100Ω resistor, it will drop 0.4 volts. Therefore, 4 to 20 mA through a 210Ω resister will drop 0.4 to 4.2 volts. For example, a 210Ω resistance may actually be 209.5Ω, therefore your voltage output will actually be 0.398 to 4.199V and not 0.4 to 4.2V as we calculated.

C. RS485 driver

RS485 can provide a data rate of 10 Mbps at distances up to 50 feet, but distances can be extended to 4000 feet with a lower speed of 100 kbps. By use of RS-485, it's possible to construct a multi-point data communications network. The standard states that up to 32 drivers or transmitters along with 32 receivers can be used on a system. This suggests that there can be 32 nodes capable to both transmit and receive.RS485 was able to provide high speed data communications. Although many other formats have appropriated, it was widely used and was able to meet the requirement for a number of applications where data needed to be transmitted at high speeds for the time. RS485 proved to be a strong standard and able to provide reliable data communications over extended distances.

D. Relay driver circuit



E. BATTERY

Lithium iron phosphate

ISSN (Online) 2581-9429

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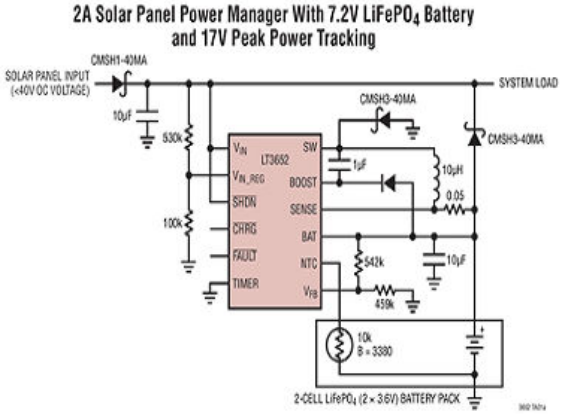
The lithium iron phosphate battery (LiFePO4 battery) is a rechargeable battery. It uses LiFePO4 as the cathode material, and anode as a graphitic carbon electrode with a metallic backing. A lithium iron phosphate battery is a type of lithium-ion battery that is capable of charging and discharging at rapid speeds compared to other batteries. We are using $2LiFePO_4$ batteries in series.

General Chemical reaction

$$LiFe^{2}PO_4 <-> Fe^{3}PO_4 + Li^{+} + e^{+}$$

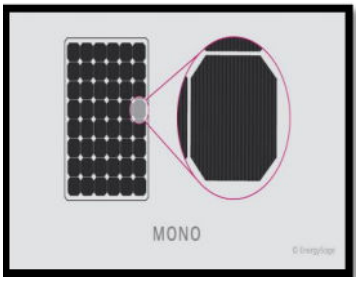
F. Battery CHARGING CIRCUIT

For charging LT3652 is used. For battery charging circuit 0.2C or C/5 charging method is used. According to this method it will provide 0.6A current for around 5hr based on circuit calculations. As full charge voltage of 1 battery is 3.6v so total battery voltage becomes 7.2v. Depending total current, voltage calculations of resistor is made. All calculations will be there in datasheet of IC.



G. SOLAR PANEL

Here we use Monocrystalline solar panel. It has high efficiency and performance. Monocrystalline solar panels have cells made of silicon wafers. To build a monocrystalline panel, wafers are arranged into rows and columns to make a rectangle, covered with a glass sheet, and framed together. Monocrystalline panels vary within the composition of the silicon itself. Monocrystalline solar cells are cut from a one, pure crystal of silicon.[2]



H. Relay

Relay states the act of passing something from one thing to other, the similar meaning can be applied to this device because the signal coming from one side of the device handles the switching operation on the other side. So relay works

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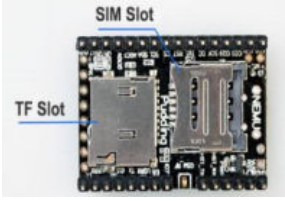
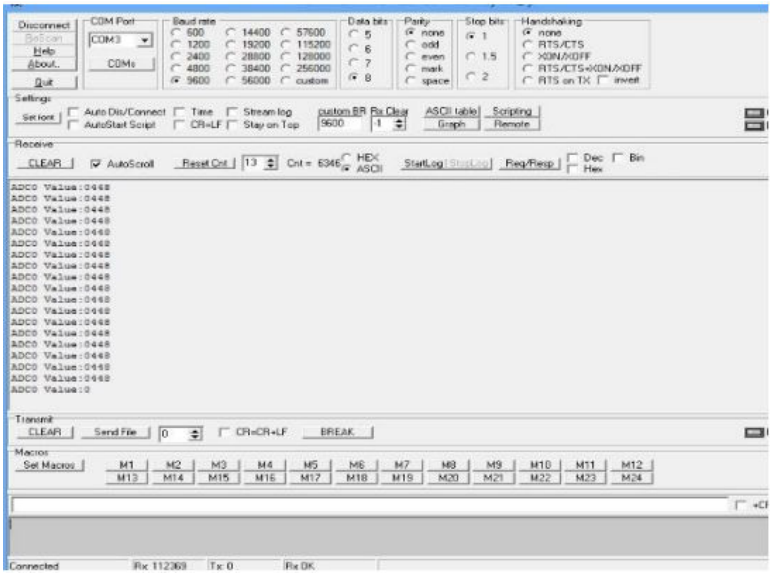
as a switch which controls (open and close) circuits electromechanically. The main operation of this device is to form or break contact with the help of a signal without any human resource involvement in order to switch it ON or OFF. It is mainly used to control a high-powered circuit with the help of low power signal.[10]

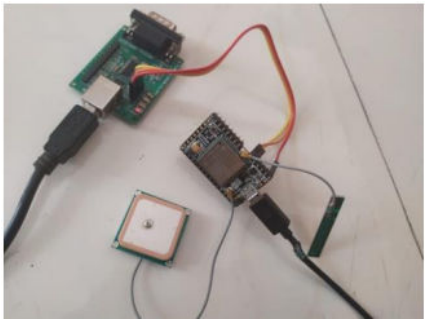
I. MICRO SIM CARD SLOT



SIM stands for Subscriber Identity Module. It is used for internet purpose to interact with the cloud . The Micro SIM card is necessary a standard SIM card with the extra plastic layout circle the circuit board is trimmed off. This SIM more likely to be used for smartphones introduced from 2010 till today. It is one of important part of gateway system in project.

IV. RESULT





Finally after lots of efforts on hardware as well as software we have designed a common setup for different types of sensor. With the help of cloud, we can access data from anywhere anytime. As it is having solar power charging support, it will work on lithium iron phosphate battery which is rechargeable type of battery. By using our mobile phone, we can monitor status of sensor, so it makes our project much more user friendly.

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V. TABLE

Comparison of different types of sensors

Parameter	Soil moisture sensor	Photodiode	Temperature sensor	Humidity sensor
Supported interface	Relay	4-20 mA	RS485	ADC
Supported voltage	3.5 to 20 V	0-5 V	1.5-5.5 V	5 to 10 V
Working temperature	10-30^{o}C	-40-100^{o}C	Depending on applications	-40 to 100 °C
Short working	Measures moisture contains in sol	Convert light into current	Detects the surrounding temperature	Measures air temperature and humidity
Circuit complexity	Low	Low	Medium	High
Cost	Low	High	Low	High
Maintenance	More	Less	Less	Less

VI. CONCLUSION

In this paper we have presented interfaces such as analog, RS485, ADC, 4-20mA (DAC), Relay, It is likely to connect the different types of sensors to the A9G module. As per work presented here it is possible to use the same setup for different fields. For data monitoring from anywhere at any time and to access the data, to control the data we have used cloud computing, hence it is easy to verify the data at any time if there is any need. To make user friendly in this paper we have used mobile phone for monitoring status. Security is provided as we have used cloud computing which provides high security to data communication. As we have used solar powered system for battery charging, it shows our system also reduces human interaction needed for charging purpose.

REFERENCES

[1]. Yen-Kuang Chen, "Challenges and Opportunities of Internet of Things", in the proceedings of 17th Asia and South Pacific Design Automation Conference, 30 Jan. – 02 Feb., 2012, Santa Clara, CA, USA.

[2]. Y. Jadeja, et. al., "Cloud Computing - Concepts, Architecture and Challenges", in the proceedings of International Conference on Computing Electronics and Electrical Technologies, 21-22 March, 2012, Nagercoil, India

[3]. Gerd Kortuem, Fahim Kawsar, Daniel Fitton, and Vasughi Sundramoorthi, "Smart Objects and Building Blocks of Internet of Things", IEEE Internet Computing Journal, volume 14, issue 1, pp. 44-51, Jan.-Feb., 2010

[4]. Dave Evans, "The Internet of Things How the Next Evolution of the Internet Is Changing Everything", Whitepaper, Cisco Internet Business Solutions Group (IBSG), April 2011.

[5]. Deter Uckelamann, Mark Harrison, and FloriaMichahelles,"Architecting the Internet of Things," Springer-Verlag Berlin Heidelberg, 2011.

[6]. GuneetMander, Mohit Arora, "Design of Capacitive Sensor for Monitoring Moisture Content of Soil and Analysis of Analog Voltage with Variability in Moisture," in Proc. RAECS UIET Panjab University Chandigarh, 06 – 08 March, 2014.

[7]. Bianca Wil, IlonaRolfes, "A Miniaturized Soil Moisture Sensor Based on Time Domain Transmissometer,'' IEEE Institute of Microwave Systems. , SU-29, no. 6, pp. 213-217, 2014 Ruhr-University Bochum, Germany .

[8]. Rishi, Ripul, Dilip Kumar. "Prototype Design of Indigenous GSM based Intelligent Irrigation System." International Journal of Computer Applications 73, no. 18 (2013): 36-39.

[9]. Pulkit hanswal, "Design of a central control unit and soil moisture sensor based irrigation water pump system." IEEE Conference on. IEEE, 2013.

[10]. Jayavardhana Gubbi, Rajkumar Buyya, Slaven Marusic, and MarimuthuPalaniswami, "Internet of Things (IoT): A Vision, Architectural Elements, and Future Directions", Technical Report CLOUDS-TR-2012-2, July 2012.