IOT Based Smart Village

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Abstract*—This paper elucidates the research and implementation of IoT based Smart Village. IoT (Internet of Things) is a structure which provides an exclusive identity and ability to relocate the data over a network without requiring two way handshaking from human-to-human. It enables the path to connect anytime, anywhere, with anything and anyone ideally using any network topology with a specify service. Hence the divergence on the scenario of a 'Smart Globe' has emerged to mean many things to many people. Meaning of "Smart" utilizes sensitive information and communications technology (ICT) remains consistent with the Internet Technologies to address rural challenges. To bifurcate the ideal scenario on the basic occupation of agriculture, the ecosystem control technology and system becomes mature having high level of intelligence. This puts precise significance on efficiency, high-quality, secure and sustainable production of facility agriculture. That makes a glance of a smart irrigation as a smart farming, ultimately converging into a 'Smart Village'. This is all about the outsourcing application, technology and wonders of [1]IoT(Internet of Things)*.

Keywords —*Internet of things (IoT), LinkIt One, Cloud Computing, GSM module, Wi-Fi module P.I.R sensor, Ultrasonic sensor, Soil Moisture sensor, Temperature and Humidity sensor.*

I. INTRODUCTION

Smart Village is an application of advanced technology in agriculture which solves a series of technical hurdles in information technology for wide area, efficient and reliable data transmission under integratedsystem. It acts as a catalyst for the transition from traditionalproactivefarming to modern farming, providing opportunity for creating new technology and service development in IoT for farming application. This paper presents an intelligent monitoring platform framework and system structure facilitating the agricultural based ecosystem under IoT (Internet of Things).The complete system consists of three subsystems, viz. the GSM module, sensor units and M2M based Cloud Computing.

BLOCK DIAGRAM

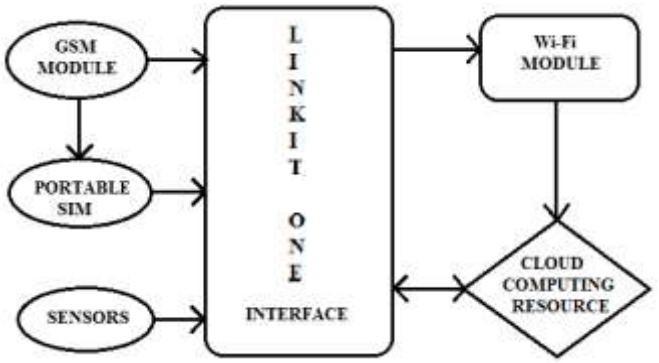

Fig. 1 Central Controller

A. *LINKIT ONE*

The LinkIt One is a development oriented platform with an open source,super stable performance board for prototyping wearable devices under IoT.Based on the leading System on Chip (SoC) such as MediaTek Aster (MT2502), wearable devices combined with high performance Wi-Fi (MT5931) and GSM(MT3332) chipsets for providing an access to all the features of MediaTek LinkIt One. It also provides similar pin-out features to Arduino boards, making it feasible for connecting various sensors, inner and outer peripherals and Arduino shields. LinkIt One is an all-in-one prototyping board for IoT wearable devices, integrating GSM/GPRS features into a basic Arduino form factor. LinkIt One is a co-design production by Seed Studio and MediaTek. It brings together two way duplexing techniques into the open hardware and industrial leading reference designs for IoT/wearables to create a significant development unit. [1][2]

B. *FEATURES*

The proactive in-build component includes SD card, GSM/GPRS units, Audio Codec, ARM7 EJ-S™ controller.The outer peripheral interfaced with Arduino boards including Digital and Analog ports.Along with it, a Power Expenditure Mode(PEM) with a power supply unit and a USB connection is also compatible with the controller. [1][2]
According to various parametric features, the values according to the usage are shown below:

Table 1

PARAMETER	VALUE
Flash Memory	16MB
RAM	4MB
DC Current I/O port	1mA
Analog pins	3(in-build)
Digital output	3.3V
Analog input	5V
GSM	850 – 1900 MHz
GPRS	Class 12
Wi-Fi Module	802.11 b/g/n

C. GPRS/GSM MODULE

GPRS (General Packet Radio Service) is typically chargeable based on the volume of data transferred, contrasting with circuit switched data, which is usually billed per minute on connection time. Usage above the bundle cap is charged per megabyte, speed limited, or disallowed.
GSM is one of the effective service for SMS (Short Message Service), implying variable throughput and latency that depends on the number of other users sharing the services concurrently, opting to circuit switching, where a certain Quality of Service (QoS) is guaranteed during the connection. In 2G systems, GPRS providing data rates of 56–114 kbps. The 2.5G cellular system undergoing Class 802.11b/g/n Wi-Fi Module will be commanded by LinkIt One which smartly exhibits the GSM module.The GPRS Class 12 is integrated with GSM(850-1900MHz) under LinkIt One interface. [1][2]

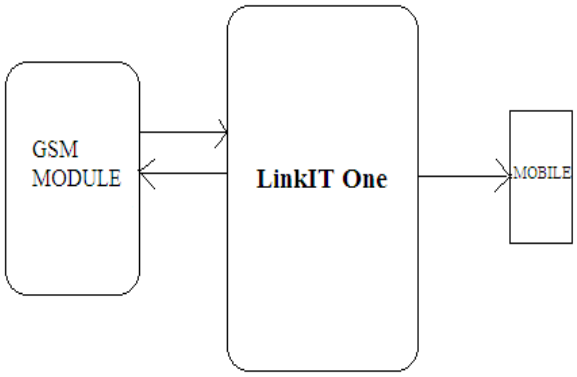

Fig. 3 GSM Module connected with LinkIt One

This GSM Module can accept any GSM network operator. It is easy to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.
The modem can either be connected to PC serial port directly or to any microcontroller.

This GSM modem is a very flexible plug and play quad band and easy integration to LinkIt One device. The supporting features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

II. CLOUD COMPUTING

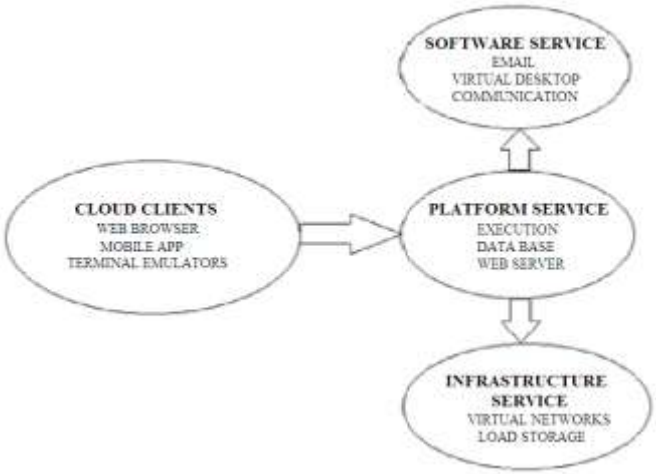

Fig. 2 Cloud Computing

Cloud computing, also known as ‘on-scope computing’, is a kind of IoT based computing shared resources, data and information which provides to the user oriented clients and other devices on-demand. It is a model for enabling ubiquitous, on-scope access to a shared pool of configurable computing resources.
Cloud computing with storage solutions providesthe user and enterprises various capabilities to store and process their data in 3rd party data centers. It relies on sharing of resources to achieve the consistency, similar to a virtual service utility over a network topology.
Cloud computing is a model for enabling ubiquitous, convenient, on-scope network an access to a shared pool of configurable computing resources that can be rapidly provisioned and released with anaffordable management.

Steps to compute Cloud Computing:

i. Send

Setup your LinkIt one device embedded with soil moisture, temperature and humidity sensor to send data to our Ubidots cloud server.

ii. Visualize

The data is visualized in a real-time dashboard. It is easy to create custom widgets like line charts, maps, gauges and more for efficiency.

iii. Take Action

Trigger SMS/Email alerts or even actuator according to your data.

iv. Share

Then the data available can be shared with colleagues, customers or 3rd party applications. [9]

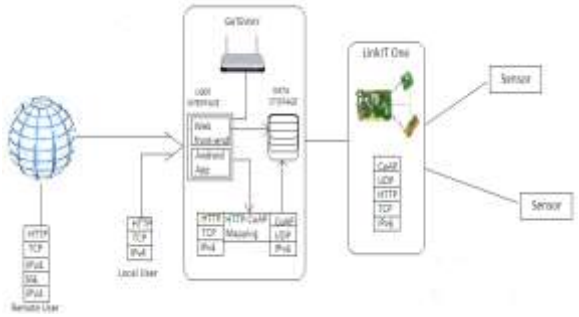

Fig. 4 Cloud Computing Working

Cloud computing is the result of the evolution and adoption of existing technologies and paradigms. The aim to make cloud computing is to allow users to take benefit from all of these technologies, without the need for deep knowledge about or expertise with each one of them. Cloud computing also leverages concepts from utilizing and computing the controlling system In addition, measured services are an essential part of the feedback loop in autonomic computing, allowing services to scale on-demand and to perform automatic failure recovery.

Cloud computing provides a kind of grid computing; it has been evolved toa specific address with the QoS (quality of service) and reliability problems [10]

III. SENSOR USED

➢ *ULTRASONIC SENSOR*

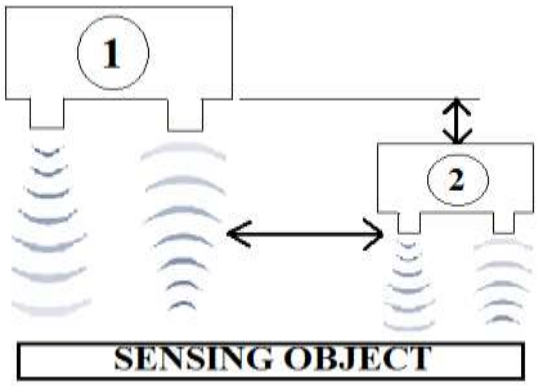

Fig. 5 Ultrasonic Sensor

Ultrasonic sensor transmits the ultrasonic waves to the moving farm/field objects (human being, animals, vehicles, etc.) from its sensor head and again receives the reflected ultrasonic waves from that object. By measuring the length of time from the transmission to reception of the sonic wave, it detects the position of the object. So this gives the exact spot of the object.

Oftenly, the high sensitivity of ultrasonic sensors leads to false trigger. For example, excessive air motion can cause the sensor to trigger. This is the disadvantage of ultrasonic sensor for its high sensitivity.Inorder to overcome this disadvantage, PIR sensors are used.[10]

➢ *PASSIVE INFRARED(PIR) SENSOR*

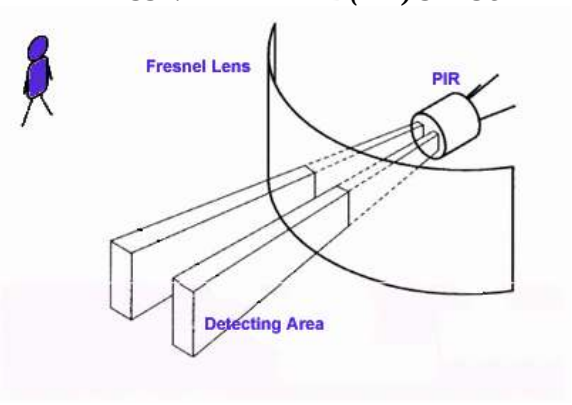

Fig. 6 Passive Infrared(PIR) Sensor

A passive infrared (PIR) sensor is an electronic sensor that measures infrared (IR) light radiating from objects around its vicinity. This PIR sensordetects the motion based movement of field vehicles, farm animals and other moving objects. We often used this in Burglar alarm control panelsand automatically activated lighting systems. Due to its feasibility and flexibility, we can get proper range of the entity and hencePIR sensors can be implemented throughout the farming area and that too with a low power supply unit.[9]

- ***Dual Technology Sensors***

Dual Technology Sensors is one of the most significant technique of combining PIR sensor with ultrasonic sensor for precise measurement. This activates when both the system detects motion. This solves the problem of false triggering by ultrasonic sensor due to things like air motion. [9][10]

However, the system will only deactivate when both technologies no longer sense motion. This solves the problem of the PIR sensor's lack of sensitivity to slight motions. The redundancy in detection method virtually eliminates the possibility of false-on and significantly reduces the possibility of false information.[3]

- ***Integration of Dual Technology Sensor***

Integrationof both Ultrasonic sensor and Passive Infrared sensor into a single application, it is necessary to ensure compatibility with each other.

The components needed when integrating an ultrasonic sensor and a PIR sensor will vary from application to application. In order to interface the sensors together; LinkIt Oneprovides a command to this integrated system.[3]

Thus the Dual service integrated technology is implemented to provide low cost Monitoring system for

Smart Village.

- ***SOIL MOISTURE SENSOR***

Fig. 7 Soil Moisture Sensor

Basically in Smart Farming, moisture content in the soil is a major factor for determining plant growth. Soil moisture sensor isa resistive sensor. It determines the change in resistance of the soil between two probes which depends upon water content in it. Since water is a good conductor of electricity in the presence of ions. So, greater the amount of electrolytes in the soil, greater will be the conductivity of the soil, means that the resistance of the soil decreases promptly.[4] It plays a vital role as a Decision Tool for farmers by providing soil information and field variation.[5][8]

- ***TEMPERATURE AND HUMIDITY SENSOR***

Fig. 8 Temperature and Humidity Sensor

The Temperature and Humidity is one of the important environmental parameters which work with a simultaneous change of climate, topography, vegetation, soil type and other factors. The soil temperature is closely related with some processes, such as crop planting time, tillering growth and winter safety. The soil water and heat migration is an important research problem. Therefore, the observation by Temperature and Humidity sensorsgives a specific idea about the variation of coolness and heat content in the soil which defines agricultural production and scientific research. [4]
The temperature is proportional with absolute humidity. The accurate and precise measurement can be more beneficial for better working of temperature and humidity sensors along with the moisture sensor. [5]

IV. ADVANTAGES

Information: It is obvious that having more information helps making better decisions. Whether it is mundane decisions as needing to know real time moisture level for better irrigation or improved security system, knowledge helps in providing better information of the farming ecosystem.
Monitoring: The second most obvious advantage of IoT is monitoring. Knowing the exact temperature and humidity or the air quality in the farm, can further provide more information that could not have previously been collected easily. Furthermore, monitoring the working of products can and will improve safety. [7]
Time: As hinted in the previous examples, the amount of time saved because of IoT is quite large. And in today's modern life, we all could use more time.
Cost: The practical advantage of IoT is low cost. The tagging and monitoring equipment is cheaply available and large scale production of sensors is possible.
Integration with Data: These sensors could prove to be incredibly beneficial for both to an individual and society. By allowing physical devices to communicate, it is taking the data that is individually collected, shared and then translating the information into many ways that makes our current system more efficient. [6]

V. LIMITATION

Compatibility: Practically, there is no international standard for the tagging and monitoring equipment compatibility. I believe this disadvantage is the most easy to overcome. The manufacturing companies of this device need to agree a standard, such as Bluetooth, USB, etc.
***Privacy/Security*:** With all of this IoT data being transmitted, the risk of losing privacy increases [7].

VI. FUTURE SCOPES

Livestock monitoring - Livestock Monitoring provides active surveillance of stock to determine location as well as the detection of predators and thieves.
The ability to monitor factors such as temperature, humidity and soil moisture helps to ensure quality output, potentially leading to greater farmer satisfaction and profitable farming. It can be very outsourcing for a company to utilize the IoT to ensure quality of service(QoS) for their clients. [6]
Indoor farming Revolution -Crops are grown hydroponically in a sterile environment with a precisely controlled climate. Plants are drip-fed nutrients and fertilizer through recycled water, while

sensors can detect which nutrients are missing; this is precision farming at its most extreme.[4]

Cloud Computing **–**Customized and flexible to use that provides multiple advanced services. Cloud based update under storage applications for smart planting.

VII. CONCLUSION

Internet of Things serves as powerful, reliable and cost effective technology to implement the idea of 'Smart Village' that aims to empower villages with advance rural connectivity through web service, measurement of environment factors like Soil moisture, temperature , humidity and implementation of cloud computing along with real time monitoring using GSM system.

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