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IOT based Grocery Management System

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ABSTRACT

The Internet of Things (IoT) is a revolution in technology where all real world objects will be connected to internet.The Emerging technology is going to give a new dimension to the way we perform our everyday activities.IOT based grocery system is smart grocery shopping assistant, which re-defines grocery shopping. This system helps us to manage grocery which is requirement for every household and bulk grocery storage areas. Here the level measurement of solid or liquid substances in grocery is studied using ultrasonic sensor, according to which the order for that particular grocery can be placed. The temperature and humidity sensors are used to store grocery under optimal storage conditions. The integration of the sensor network with the cloud provides storage and computational resources .This way the scalable sensor infrastructure will be reliable and secured .The real-time alerts of grocery parameters ensures the level and proper storage of grocery .This system introduces the simple implementation of a usable application with the low cost solution.

Keywords: IOT; Grocery; Cloud integration; Management;Level sensor;

I. INTRODUCTION

Internet of things extends the computing capability and connectivity of network to objects around us. Connecting these objects together will allow them to exchange data without human intervention. Actually, the concept of connecting computer systems with sensor networks and other module exists since many years. IoT implementations use different technical communications models, each with its own characteristics.

Grocery Management is one of the unlimited applications of IOT. Grocery shopping is a time consuming activity of every house hold and it becomes more tedious when it has to be done on large scale for e.g. in restaurants, hostel mess, and office canteen. It requires the monitoring of various items present in the storage. The proposed system is an application that has been designed for the next generation smart shopping system. This system will help the user to get proper management of grocery in kitchen. The user no longer has to worry about continuously monitoring groceries at our homes. Here we get notification when the level of content in the storage bottles or containers will be low, then immediately the order for that particular content will be placed. Level measurement is the continuous task going on here by level measurement sensor the storage of the grocery is also an issue. It is important that our food items should be in the proper storage environment otherwise they cannot be used further. This system will give us idea about the temperature inside the bottle or the container so that protecting the content according to the weather conditions, and suitable temperature can be maintain for different content as per its requirement. Temperature is measured using temperature sensor. Some food items are sensitive to humid environment, for that purpose humidity sensor is also used .When the management of grocery is considered on large scale like for hotel chains, there will be a large number of sensor nodes. The amount of data that will be processed by the sensors will increase and we require large storage for data also it requires fast processing for real time monitoring which cannot be provided by the processor on the sensor nodes. The security of data is also an issue in this scenario. So, the solution is to integrate the whole grocery management sensor network with the cloud which solves the issues of large data management.

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II. RELATED WORK AND BACKGROUND INFORMATION

Ultrasonic Sensors are Intelligent Sensors, which use the phenomena of wave-propagation in air for the measurement of physical or chemical variables. According to the principle there are two types of sensors. Propagation Path Sensors which check changes on propagation to get measurement and Distance-Sensors which detect echoes from objects and evaluate their propagation time and amplitude [1].these distance sensors can be used to detect the level of grocery. Ultrasonic sensor is mounted such that the it can measure the level of solids and liquids from the see through cap of the containers [2].the sensor used is UCL-510 which is a general purpose ultrasonic Continuous level Sensor and is used for wide range of substances. The weight of grocery items can be checked by using the load sensors [3]. Ultra precision mini load MDB 2.5 is used [2] as it includes the most sensitive load cell. To maintain the quality of grocery items the temperature and humidity are the important parameters. If Humidity level is greater than 60% it may cause dry foods to draw moisture resulting in getting staled [4] and temperature range is different for different food items . Generally items can be stored at temperature below 25°C[4].For food grain 70% humidity and maximum temperature considered is 40°C [5] . The food storage system can be monitored and controlled using low power modules such as Zigbee and Bluetooth modules [6].Some systems use RFID tags attached to the items which contain the product description and will identify uniquely. RFID tags has antenna called inlay and an integrated circuit which has a tag identifier and marked electronic product code. Every item has its product code as grocery item and tag identifier. The place where grocery items are stored are mounted with antenna which reads the stamped information present on the tags. This antenna communicates with the tag antenna to transfer the information [2].The payment for the grocery can be done by information stored in the RFID tags . [7].Here to manage the scalable system cloud computing is attached to the system. Now as Internet of Things (IoT) becoming so extensive it is important to integrate it with cloud computing as there will be large amount of data that will be generated. This integration will provide privilege to utilize to take the storage capacity and virtual resources which will provide support to smart applications [8] [9] [10].

III. SYSTEM IMPLEMENTATION

The proposed system consists of the the containers which are used to store the grocery items which holes in it to fit the utrasonic sensors and temperature and humdity sensors in it.these sensors are connected to the microntroller which processes the values of the humidity , temperature and level of grocery items.the information related to the particular grocery items is present in the memory of the controller. The microcontroller is connected to the ethernet cable and power system. The ethernet cable goes to the ethernet module which helps is connecting the system to internet through modem. The system is connected to the cloud where we can login by using the API key and the authentication token. This login provides us the real time data in the graphical form.for visulaisation many types of graphs are available. The facility of the historic data is also provided.When the value of the gocery item becomes less than the defined threshold a notifiction through mail will be sen to the user which will provide the status of the grocery item where it is stored.

The ultrasonic sensor used is HC-SR04.It takes 5V and ground connection to work which is provided by the Arduino microcontroller. The range of Hc-SR04 is 2cm to 400 cm [11]. The height of the container considered for prototype is 15cm. hence HC-SR04 fulfils the requirement. As we are taking two containers two HC-SR04 are used.

For sensing the temperature and humidity DHT11 is used. The measurement range of DHT11 is 20-90%RH for humidity and for temperature 0-50 °C [12] which is sufficient for our application.

The value of temperature, humidity and level is given to the microcontroller. The microcontroller used is Arduino uno which is based on Atmega 328. The microcontroller has sufficient speed and memory for our prototype.

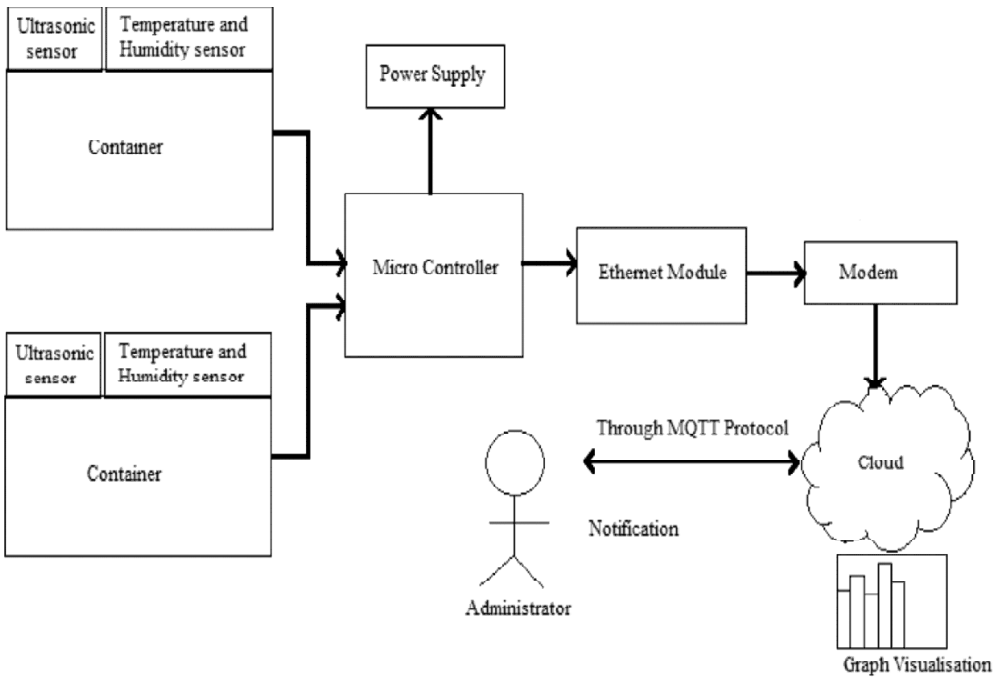

Figure 1: Block diagram of the proposed system

The microcontroller runs on 5V of dc supply which is provided by the battery.

To connect the system to internet an Ethernet module is connected to Arduino Uno. This is further connected to Modem to provide internet connection.

We run node.js environment through command prompt to run connect to web. Then we login into the IBM Internet of Things Foundation with API key and Authentication token. When we login in to cloud we have to select the device name which is “aaabbbccc” in our system. Page appears which has the features of live data and historic data. The visualization of the parameters can be done using different types of graph. If the value of the level sensor becomes more than 12cm, this means the grocery item is about to finish and we require to order more. This notification is send to the administrator automatically.

IV. USAGE OF CLOUD

IOT and Cloud are two independent structures. Their integration will provide many opportunities in future. Cloud has capability to overcome the restrictions of IOT. The most important amongst the all is data storage. When the large network of sensors and modules i.e. the information sources will be connected together it will consist of Big Data [13] having the characteristics:

i) Volume : the size of data

ii) Variety : different types of data

iii) Velocity : frequency of generation of data

Cloud is capable of providing low cost [14] and unlimited storage. As we are using API key to access data it makes the storage secured. The complementary nature of IOT and Cloud is shown below

In the proposed system the platform uses is IBM Bluemix Cloud as it delivers flexibility and control over cloud application. The infrastructure provided is flexible that is why it is used by many companies [15].

For machine to machine communication (M2M) there are many protocols that are suggested such as CoAP, MQTT, MQTT-SN, and AMQP [16]. MQTT has become interest of many industries and embedded

IoT	Cloud
pervasive (things placed everywhere)	ubiquitous (resources usable from everywhere)
real world things	virtual resources
limited computational capabilities	virtually unlimited computational capabilities
limited storage or no storage capabilities	virtually unlimited storage capabilities
Internet as a point of convergence	Internet for service delivery
big data source	means to manage big data

Figure 2: Complementary and integration of cloud and IOT [14]

researches and many of its implementations are already running. It is specially designed for environments where there is less bandwidth, limited processor and memory.

V. RESULTS

After compiling and uploading the program into microcontroller .The parameters can be viewed on the serial monitor.

Figure 3: Values of grocery level, temperature and humidity on serial monitor

After login with API Key and Authentication Token IBM Internet of things foundation provide this page where live data on graph can be viewed.

VI. CONCLUSION FUTURE PROSPECTS

This paper proposes a grocery management system where Machine to machine (M2M) communication takes place between the sensor nodes and the administrator mobile. Notification through mail is sent according

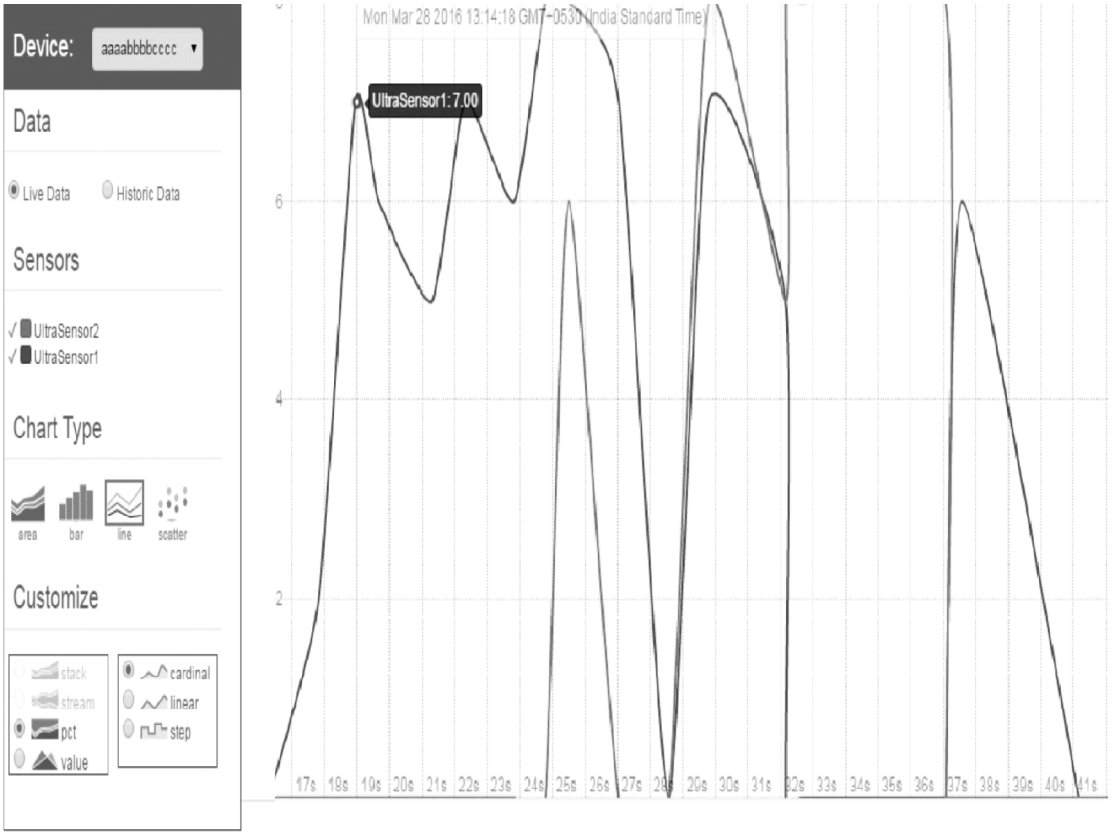

Figure 4: Real-time line graph of level using Ultrasonic sensor

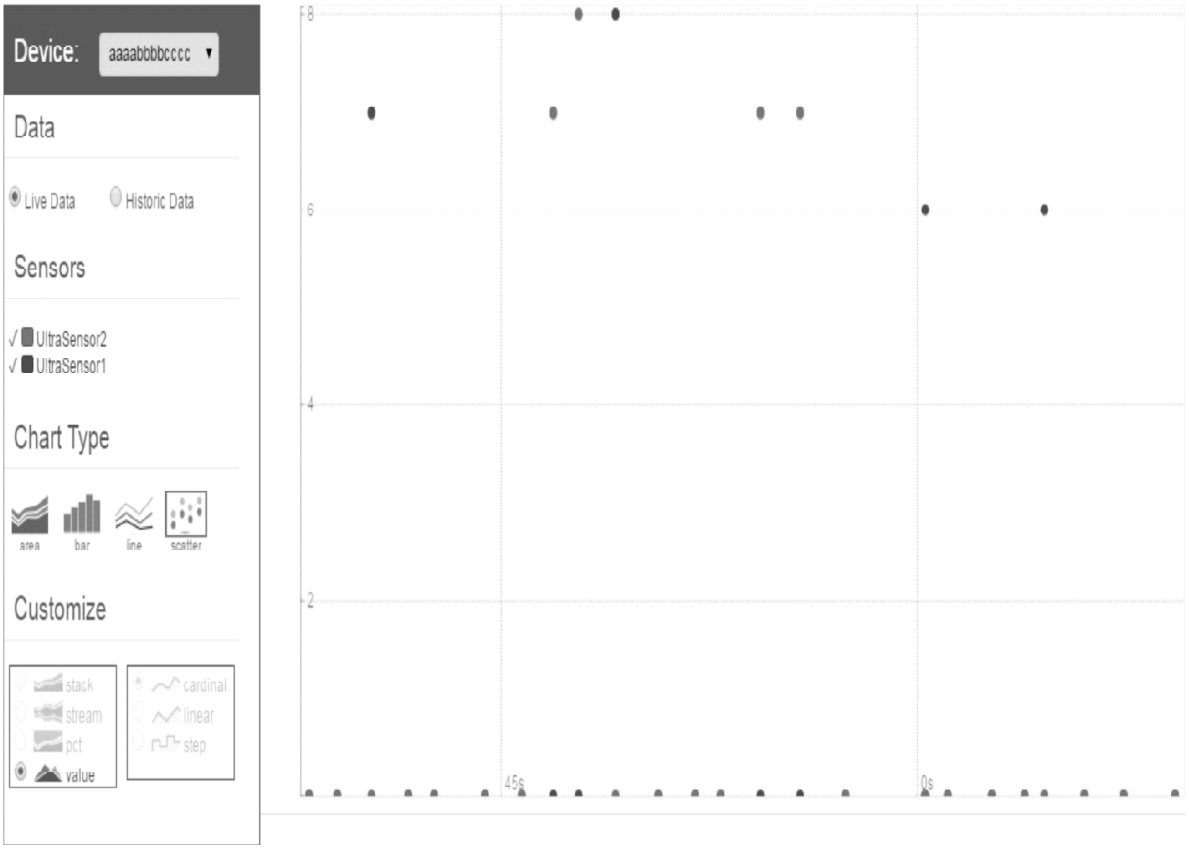

Figure 5: Real-time scatter graph of level using Ultrasonic sensor

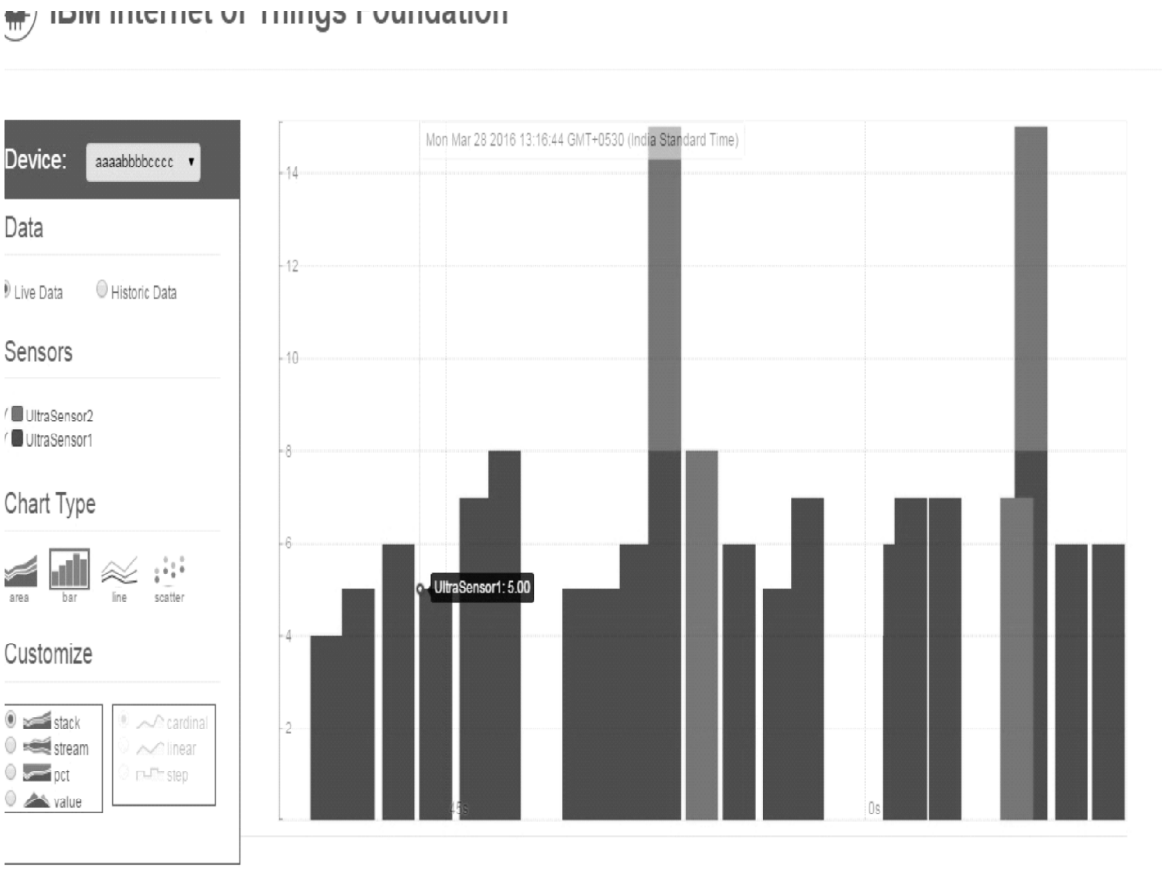

Figure 6: Real-time bar graph of level using Ultrasonic sensor

to the Level of grocery, temperature and humidity values of the environment where grocery items are stored. For visualization of live as well as historic data, graph representation is chosen on the cloud. The usage of cloud permits access only by authenticated users which makes the system secured. This system is an easy implementation as it does not require Bar Codes or RFID tags to put on each container.

VII. FUTURE PROSPECTS

In future there can be many features that can be added to the system to make it better. The information related to the grocery item can be stored for e.g. for pulses different brands available, cost, manufacture date, expiry date etc. the address, email id and phone number of different vendors can be who can supply the grocery. Better visualizations can be developed using cloud platform.

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