Generic IoT Platform for Analytics

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Abstract: Internet, since its root has reclassified the manners by which the world collaborates today, countless devices speak with each other which make our life simple and thus improve this world a place to dwell. The Internet of Things (IoT) is the system of physical gadgets, vehicles, home machines and different things implanted with hardware, programming, sensors and network which empowers these objects to interface and trade information. Today the world has swung to a place where each and everything should be associated. This paper discusses, how a generic IoT platform has been developed to get the data from various sensors from agricultural lands and conversely control the devices from distant places using Internet. For e.g., a smart plug can help you save and monitor your energy consumption by showing energy statistics. Sensors fitted in agricultural lands has been chosen to test the quality of the IoT platform.

Index-Terms: Node Red, Raspberry Pi, DHT11, Node JS.

1. Introduction

The Internet of things (IoT) is a processing idea that illustrates the possibility of ordinary physical items being associated with the web and having the capacity to recognize themselves to different gadgets. The term is firmly related to RFID as the strategy for correspondence, despite the fact that it likewise may incorporate other sensor innovations, remote advancements or QR codes.

The IoT is huge on the grounds that a protest that can speak to itself carefully moves toward becoming an option that is more prominent than the question independent from anyone else. Never again does the question relate just to its client, however it is currently associated with encompassing articles and database information. At the point when numerous articles demonstration as one, they are known as having "surrounding knowledge". Internet of Things (IoT) is the setup of all the physical gadgets that we can envision in our everyday life for gathering and transmission of information through different sensors. This makes life simple with negligible human interruption.

Creation of a Generic platform for data transmission and reception from various sensors and plotting the graphs on a dashboard was developed using JavaScript. It also includes the process to setup a Smart plug in which a device can be plugged in and controlled using a dashboard application after authentication. The data transmission is secured so that no external user can see the information that is being exchanged between an authenticated client and server.

The data exchange is done using MQTT protocol and ESP8266. ESP8266 is the WiFi module which includes a microcontroller unit that can be programmed using Arduino IDE. ESP8266 connects to the active WiFi connection and supports the data transmission using MQTT. Various libraries have been included in the project and corresponding links have been provided in this documentation.

The project is divided into two sections

- **Hardware section:**

Hardware section involves arranging the setup and making the circuits required for the project. It also includes setting up the ESP8266 module and programming it is using Arduino IDE.

- **Software section:**

The Software section includes creating a Web Application for the user using NodeJS and WebViewer in Android Studio. It provides many functionalities to the user like adding a device, controlling it etc.

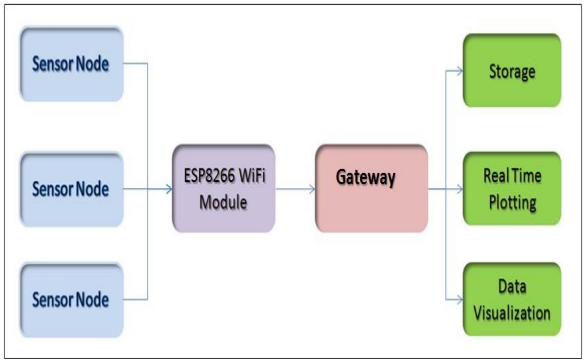

Fig. 1 Generic IoT Platform for Sensors flow diagram

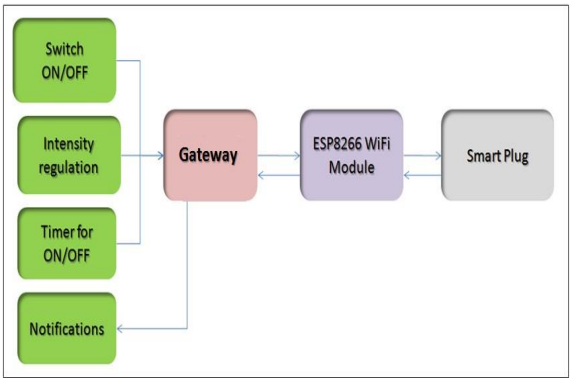

Fig. 2 Smart Plug Flow diagram

2. Literature Review

Hamdan Hejaziin [1] explained an overview on IoT stages, talking about their models and basics of IoT building components and the corresponding conventions between them. This helps the per user to pick a reasonable and sufficient IOT platform for own demands. M. Nelwin.Rajkumarin [2] outlines about IOT technologies and applications interconnected to agriculture with contrast to pumping motor on and off. Also live streaming of farm on android mobiles by using WiFi can be watched. Priyanka Padalalu in [3] explained the idea which helps the farmer in irrigating the farms efficiently using automated irrigation system which is based on values from soil, moisture and pH sensors. The data collected is recorded from time to time to the server and can be acquired via android app. Rajalaxmi.P in [4] explained that in order to automate the irrigation systems, sensors are installed in the field for supervision. Wireless transmission is used to conceal data in database of server. If the moisture and temperature of the field falls below the threshold, the irrigation is automated. The farmers mobile are sent with notification regularly. Farmers being situated in any part of the world can observe the status of his field.

In areas where water is inadequate this system is useful. Compared to traditional approach this system is 92% more effective. The system is cost effective. Also Power consumption is benefit able. The system can be used in Green houses to control the light intensity. There is increase in Crop Production and wastage of crops is less compared to traditional farming. Gives feasible results. Guruprasadh JP in [5] explained information about soil moisture and Nutrient deficiency obtained from Intelligent sensors. The information obtained can be utilized to automate. Modern electronic technology with automatized features which makes use of microcontroller can detect the dampness content of the earth and turns the pumping motor on and off.

3. Objectives:

A generic IoT platform helps us to get the data from various setups and conversely control the devices from distant places using internet. The readings of temperature and humidity sensor can be used to control an air conditioner.

A smart plug can help you save and monitor your energy consumption by showing you energy statistics. Moreover, it will help you regulate the intensity at which your device operates which will indeed help you save power.

This project is beneficial for budding IoT enthusiasts as it would help them to gain an in-depth understanding of IoT and make a project which they can implement in their daily lives.

4. Experimental Setup

A. *Hardware components*

1.DHT11: Output will be temperature in degree Celsius and relative humidity in percentage. Data pin connected to digital pin gives digital output. Capacitive Humidity sensor to measure the relative humidity and thermistor to measure temperature of surrounding.
2.ADXL335-Accelerometer: Consists of three axes for sensing
(x, y, z). Output will be signal conditioned voltage output for each axis proportional to acceleration.
3.Light Intensity Sensor: Voltage Proportional to light Intensity in the output, use analog Read to read it.
As light intensity increases, resistance of LDR decreases therefore voltage on Analog pin also decrease as light intensity increases.
4.RFID: Radio-frequency identification (*RFID*) uses electromagnetic fields to automatically identify and track tags attached to objects.
The tags contain electronically stored information. The tags are further classified into two types.

a. Passive Tags: Operate from short distances as they collect energy from a nearby RFID reader interrogating radio waves.
b. Active Tags: They have a local power source such as a battery and may operate at hundreds of meters from the RFID reader.RFID can be used for security purposes.

5.Node MCU: NodeMCU development board is Open Source IoT platform. NodeMCU is a small board, based on ESP-12E WiFi Module from AI-Thinker, itself containing a single-chip ESP8266 WiFi-SoC.
6.Relay
7.Motor
8.Tungusten Bulb
9.MQTT protocol: MQTT (Message Queue Telemetry Transport) is a lightweight publish subscribe protocol for IoT based application. MQTT is preferred over HTTP protocol because HTTP protocol requires handshaking for every request whereas, on other hand, MQTT is a simple protocol where data gets published and subscriber receives it by subscribing to that particular topic.
10.Raspberry Pi: The Raspberry Pi is a low cost computer and can function as a proper monitor. Raspberry Pi can be used to build smart devices where it acts as a Gateway. Raspberry Pi is usually slow than our normal laptop, but is still a Linux computer. Though Raspberry is slow it is preferred over computers as its power consumption is quite less.

B. Software Requirements

1. Adding NodeMCU/ESP8266 board to Arduino IDE
2.Installing Mosquitto Broker for MQTT in Ubuntu
3.Installing node.js for Node-Red
4.Installing Node-Red
5.Installing UI Dash Board on Node Red

C. Technology used

1. Canvas Gauges: are open source minimalist HTML5-based components for web applications.

2. JQuery: 3.1.1: JQuery is one of the most popular JavaScript library used to make the client-side scripting of HTML easier.
3. Node JS:Node.js is a platform built on Chrome's JavaScript runtime for easily building fast and scalable network applications. It is an open source server framework that allows us to use JavaScript on the server.
4. Node Red: Node-Red is a software tool built on Node.js developed by IBM which makes it easier to wire together hardware devices. It provides simple browser based editing facility which makes it easier to create flows just by a simple drag of the mouse. The flows can then be deployed at runtime.

5. Generic IoT Platform for Sensors

- *Schematic for Sensor Setup:*

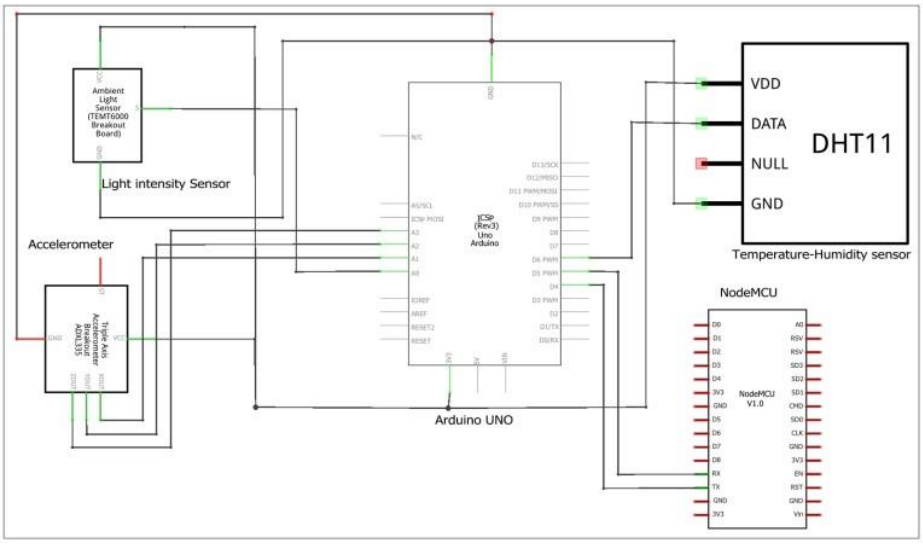

Fig. 3 Schematic for sensors setup

Above Figure shows the Hardware setup for Node MCU and sensors.Sensors like DHT11, Light Intensity sensor,Accelerometer are connected via Aurdino, Node MCU.

B. *Algorithm for Generic IOT Platform*

Above flowchart shows the step by step process of how the data is collected from sensors and visualization is done on node red dash board. First step code is to upload the code to aurdino-UNO and Node MCU.As soon as the data is received by the aurdino, serial communication between the aurdino and Node MCU starts. Node MCU is connected to the wifi and Mosquitto broker. The Encrypted data is published by the client to the broker and other client subscribes the data from the broker. Inturn, the visualization of data is done on the Node Red Dash Board.

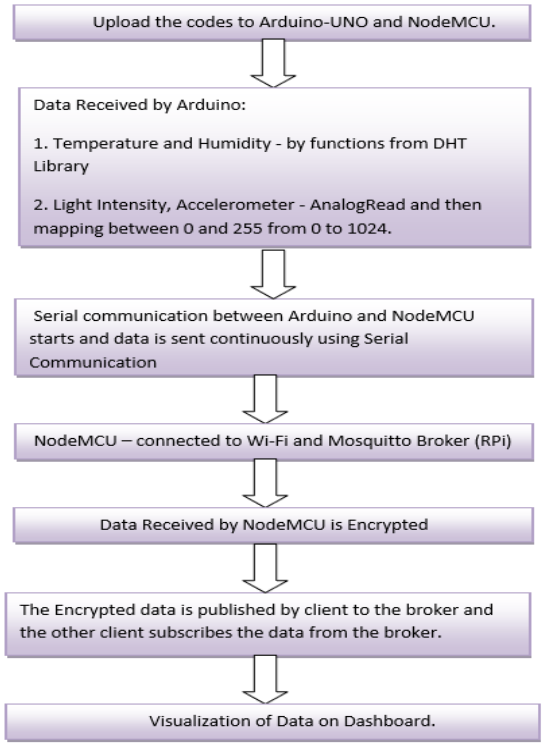

Fig.4 Flow for sensors

C.Flow in Node Red

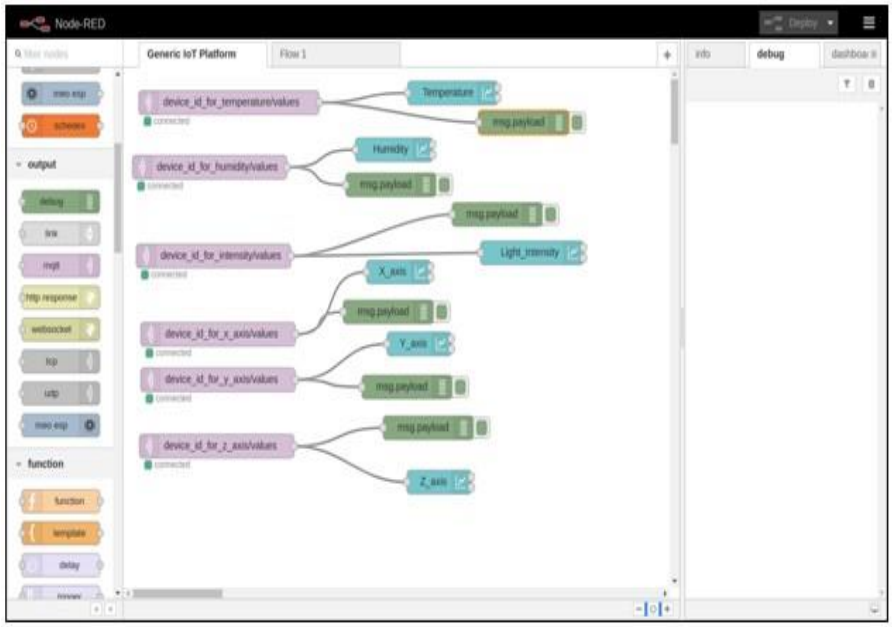

Fig.5 Flow in node red for changing sensor values

Figure above shows the flow of data among the sensors in node red where visualization entire setup is showed.

D.Results obtained on Node Red

Figure.6 Results obtained on Node Red Dashboard

Figure above shows the graph where time versus value is plotted for values of temperature and humidity during different time intervals.

- The user can view the current reading of the sensors through the gauge chart.
- Time vs Value data of the device is plotted through line chart in real time.
- The user can see day-to-day analysis of the device readings through a line chart.

6. Conclusion

A platform for data transmission and reception from various sensors are created (Node MCU and Temperature sensor) and the graphs are plotted on dashboard developed, the gauge chart provides current readings of the sensor which can be viewed by the user. Every day analysis of device readings through line chart can be seen by the user through line chart.

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