Low Cost Standard Internet of Things

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Abstract— At the verge of the universe, everything around us growing rapidly. From small things like eating, sleeping to big things like flying etc, have changed dramatically. With the involvement and twist of technology, we are changing each and everything around us, our habits, use, needs everything including us. We are much more conscious about our day to day life data like how many hours you sleep, how many times you have to water plants and you want these data to be available to us anytime and anywhere. So that you can use this data to improvise yourself and produce the maximum result out of it. For this we moved to cloud for storing our information. But soon we realized that we not only wanted the data on the cloud but we wanted the sorted and exact data due to which cloud computing took into place. And slowly small things started to store data on the cloud and the whole project was called IoT or Internet of Things. The basic concept of IoT was to connect each and every small device to the cloud which will constantly feed the data on the cloud and we the user will access it from anywhere and anytime we want. Not only view the data but to access the data and the device with lesser complexity.

Keywords—Wireless Sensor Network

I. INTRODUCTION (*HEADING 1*)

The main objective of this paper is to develop a system which is low cost and which can directly connect this local system to the cloud and will be easy to monitor and control. There will be a network of sensors which has a technical term Wireless Sensor Network, which will collect all the local data and feed it to the central server which will then upload the data to the cloud. The general architecture includes many nodes which are referred as ”child” nodes and the central node which gets all the data from the child nodes called as “Parent” node. There can be multiple parent node also connected to various child nodes. These parent node act as child node to other parent node which collects data from these parent nodes. Once the WSN has been performed, the data can be now transferred using the current base protocols for transmitting the data. Since, we are using NRF, we will follow the protocols issued by standard IoT protocols set by NRF Library and mysensors.org where we can directly find the NRF data sending and receiving methods on conventional WSN networks which are using NRF and Arduino to form nodes. We are currently proposing a system where rather than connecting each and every sensor directly to the internet we are connecting this to the local servers and then connecting, the local server to the global server. This will make the system more reliable and more secure. For local server we are using spark core device which will collect all the data from the user and then it will directly upload the data on the cloud which comes with the spark core. The cloud is so feasible and easy to operate that it can be directly access by the spark device. To protect the spark core from getting directly damaged because of users mistakes, an arduino will be used to track and manage the amount of data and the control which it will gain through the Wireless Sensor Network. The arduino will then transfer the data to the spark core and then spark core with the help of Wi-Fi will directly upload it on the cloud. It will parallel update the data of present active sensor network. Through interfaces made in REST API and Node.js, we can make a very easy and user friendly GUI for the user. Who without any technical knowledge can easy operate and use the Technology for fields like irrigation, health and corporate sectors. There are numerous opportunities and applications of this field and technology. The emphasis by this project is given on developing a low power, low cost, open source and user-friendly version of Internet of Things which will make the world more connected and easily affordable for anyone. And making it global to be used in any kind of application and any kind of field.

II. METHODOLOGIES

A. Internet of Things using Arduino

The Spark Core is an Arduino-compatible, Wi-Fi enabled, cloud-powered development platform that makes creating internet-connected hardware a breeze. This little board packs a punch: with a 72 MHz ARM Cortex M3, the best Wi-Fi module on the market, wireless programming, and lots of pin outs and peripherals, there's nothing you can't build with the Core.

B. Using Arduino as tiny nodes

Most of the researches will Use the arduino platform for developing the tiny nodes. Since arduino is low cost and open source, we are also implementing the arduino to form nodes. There are currently various existing controllers on arduino platform each having a different version of flash memory and

IO pins. According to our demand in the project the Arduino UNO is the best suited for making the nodes of the sensor since it is low cost and easily available. Also the SMD version of the node will consume less power which can last up to 6 Months depending upon the type of battery power supply given. Also the Analog pins which are available on the controller are enough for the need of the project making it best suited to make tiny nodes.

C. Using NRF24l01

The nRF24L01 is a single chip 2.4GHz transceiver with an embedded baseband protocol engine (Enhanced Shock Burs), designed for ultra-low power wireless applications. The nRF24L01 is designed for operation in the world wide ISM frequency band at 2.400 - 2.4835GHz. An MCU (microcontroller) and very few external passive components are needed to design a radio system with the nRF24L01. The nRF24L01 is configured and operated through a Serial Peripheral Interface (SPI.) Through this interface the register map is available. The register map contains all configuration registers in the nRF24L01 and is accessible in all operation modes of the chip. The embedded baseband protocol engine (Enhanced Shock Burst) is based on packet communication and supports various modes from manual operation to advanced autonomous protocol operation. Internal FIFOs ensure a smooth data flow between the radio front end and the system's MCU. Enhanced Shock- Burst reduces system cost by handling all the high-speed link layer operations. The radio front end uses GFSK modulation. It has user configurable parameters like frequency channel, output power and air data rate. The air data rate supported by the nRF24L01 is configurable to 2Mbps. The high air data rate combined with two power saving modes makes the nRF24L01 very suitable for ultra-low power designs. Internal voltage regulators ensure a high Power Supply Rejection Ratio (PSRR) and a wide power supply range. This ultra-Low power consumption and low cost makes the NRF very suitable for using in the WSN technology, since it will make the whole structure more cheaper and fast to implement

III. SPARK CORE AS PARENT NODE

A spark core is a tiny development board which has inbuilt Wi-Fi module in it. It is best suited for parent node as it gets the capability to upload the data on the cloud directly. The spark core has advantage over other IoT device because it has its own cloud which is way faster in its way and working. The data on the cloud is safe and easy to handle.

IV. PROPOSED SYSTEM ARCHTECHTURE

The current proposed system architecture is explained using figure 1. In the figure, as we can see, there will a mesh of sensor network where there will be tiny nodes connected to the sensors and they will transmit the data on the Spark core using NRF trans-receiver which works on 2.4 GHz. Now the Spark Core can be made available on the global network using internet.

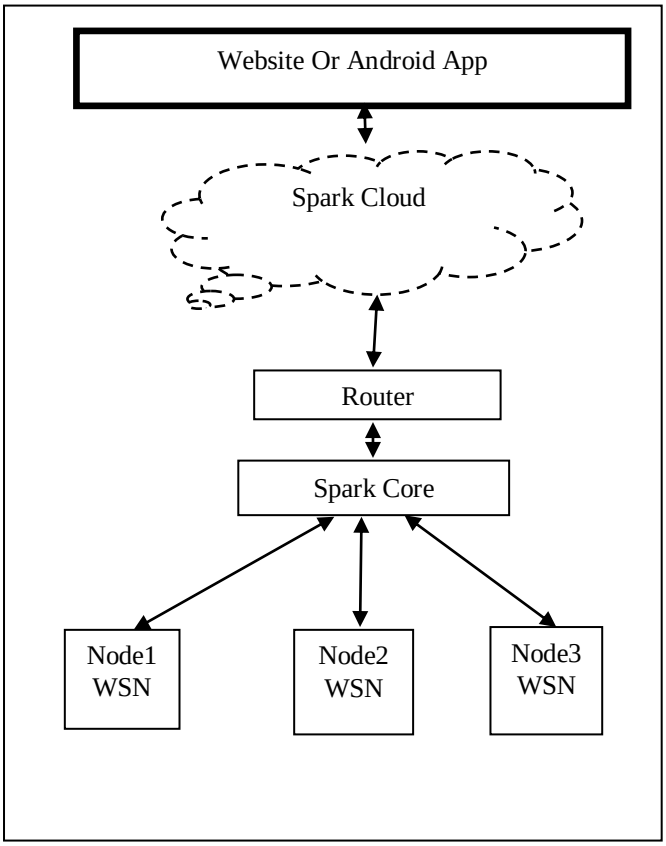

Fig. 1. Block Diagram of Internet of Things using Spark Core

The main advantage is that there is no need to attach a dedicated controller for every single sensor. The Arduino Uno has 8 ADC pins i.e. we can connect 8 sensors of different types on a single node and 14 IO pins through which we can send and control over 14 different appliances and devices. Making it to cover maximum area and multiple number of sensors. This advantage will also make the whole architecture cheap to implement.

The architecture for transferring the data we are using is in pipelined architecture based on timesharing basis. Where the parent node will collect the data from its child nodes one by one at a time on time sharing basis. The tiny nodes and the parent will be smart enough to detect each other and will act like a private ad hoc network where if any new node has to be added then it will directly be included in the network making the new node adjust in the current network.

The controlling system in the nodes will act as same, the phase of the nodes will be in transmitting as well as listening

mode concurrently, when a node wants to send the sensor data and also take the data from the parent node for turning on any relay, then when the parent node gives the time sharing to that particular node then it will first send the data and then listen to the data. Once it is finished, then the parent node gives the time to the other following node covering each node of the network and then starting again.

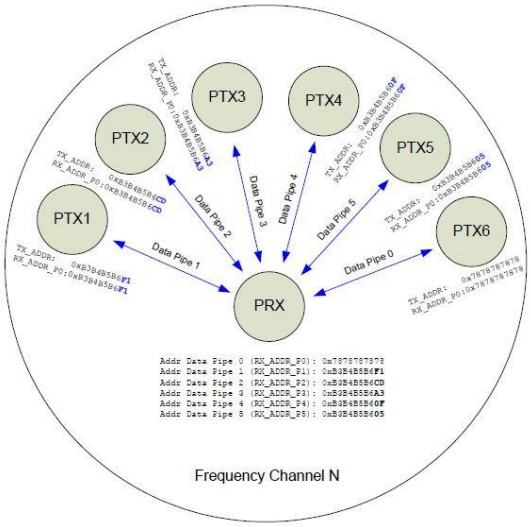

Fig. 2. Pipelined Architecture

As shown in Fig. 2, the pipelined architecture which we are currently going to use in the system. The central node will be responsible for assigning the addresses to its child nodes which will send the data to its parent node in timesharing basis. The addressing will be permanent in that particular network area. It will help to distinguish itself from other nodes.

V. Evaluations

To evaluate the current system architecture, we can use SMD version of the peripherals used in the present system which will make it more cheaper and rate cut off on the present system will be up to thirty percent. The SMD of Arduino UNO and NRF will cut down the whole cost. Also multiple servers can be connected to form a meshed network and a dedicated central server can be made which will collect the data from the various spark core present in different regions of the world. The dedicated server must be capable of handling the data coming from various spark core servers and managing the data properly. In this way we can get a reliable kind of network for all types of applications including medical, irrigation, forensic, environment monitoring etc. Also this will be proved to be the cheapest solution for creating a global wireless sensor network.

VI. Conclusion

In this paper we have explored the various possibilities of creating a reliable and low cost solution for implement the Wireless Sensor Network. We have explored the methods of creating a low cost server which can collect the data from the local servers and upload it to the global server or itself become the global server. The easy interface design and ease to access makes it more secure, reliable and secured. There are many multinational companies which are currently working on Internet Of Things who are currently exploring numerous possibilities of achieving the task. Spark core is the new thing in the IoT field which is totally based upon global cloud form and is totally oriented for IoT. The low cost and less maintenance makes it best device suitable. Heavy researches in various companies, countries and organizations are going on this current technology. The day is not far where our tiniest things like refrigerator, toaster, oven etc. will be connected to the Internet. And they will become smart enough to help you in day to day activities making the world a better place to live.

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