A Method of WSN to Monitor Cold Chain Logistics as Part of the IoT Technology

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Abstract

The Internet of Things (IoT) is a new evolution in technological advancement taking place in the world today. This paradigm allows physical world objects in our surroundings to be connected to the Internet. This idea comes to life by utilizing two architecture; the Sensing Entity in the environment that collects data and connects itself to the cloud and the Cloud Service that hosts the data from the environment. The combination of wireless sensor networks and cloud computing is becoming a popular strategy for the IoT era. The cold chain requires controlled environment for sensitive products in order for them to be fit for use. The monitoring process is the only assurance which tells if a certain process has been carried out successfully. Taking advantage of IoT and its benefits to monitor cold chain logistics will result in better management and product handling. This paper looks at a system comprising of MCU wireless sensor network and server which can be an ideal system to monitor temperature and humidity of cold chain logistics.

Introduction

Cold Chain logistics refers to the transportation of pharmaceutical products, biologics and active ingredients in controlled temperature environment. These temperature sensitive items require such environment to the very last stage of the cold chain so that they do not lose their potency and is fit for use or consumption. This applies to both high-risk and low-risk products such as insulins, vaccines and blood products. The counterfeit products are a real threat to public health and safety.

In the early 1990's, Food and Drug Administration (FDA) and Department of Agriculture began to convey the Hazard Analysis Critical Control Point (HACCP) rules as a systematic approach to food safety. The same principle has now been applied to other industries dealing with temperature sensitive products such as the pharmaceutical industry. The HACCP management system addresses various circumstances for product safety and among them is the handling and distribution of the finished product. HACCP has become universally recognized and accepted standard for product safety and has been adopted by the WHO Standards Programme. At every point in the cold chain, precautions are taken to ensure that the external conditions do not have any effect on the quality and stability of the products. Records of essential parameters such as temperature and humidity are maintained to provide evidence of compliance with recommended storage conditions.

The IoT technology ties the physical world objects to the Internet and gives the flexibility to easily monitor and manage them. This body brings new perception to the way in which we interact with our environment on multiple levels including cultural, business, social, environmental, *etc.* The sensor entity which is emerging into IoT is wireless sensor network. Wireless sensor networks are spatially distributed autonomous sensors that monitor physical or environmental conditions. Applications of WSNs are in the areas such as structural health monitoring, health monitoring, environmental observation, habitat monitoring, and tracking among others. These networks can be composed of thousands of small smart devices with computational capability and memory, one or more sensors and a limited power supply. The continuous progress in emerging sensor technologies such as WSNs has inspired IoT as this technology allows wide and cheap deployment of sensors on a large scale.

The integration of WSNs to the Internet needs high performance computing and storage infrastructure to perform real-time data processing and storage of

data from WSNs and analyzing processed information to extract events of interest. For this reason, cloud computing is proving to be a promising technology to provide flexible computing, storage and software services in a scalable and virtualized manner. Sensor cloud infrastructure is a secondary form of cloud computing that has been proposed by several IT people in present times. Sensor cloud allows managing of physical sensors on IT infrastructure. By utilizing the sensor cloud platform, several matters such as storing of collected data and processing them have become simple. Many real life applications are being assimilated to the sensor cloud including environmental monitoring, structural monitoring, disaster monitoring, agriculture, health care, telemetry, *etc*.

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