Food Quality Control Using Modern Technology

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Situation

The food industry continuously adapts to new technology mainly because of the variety of processes that are involved in the production of foods and beverages, ensuring the sustainability of the quality of the products. “The quality is defined as degree of excellence and this excellence is contributed by nutritional, sensory and hygienic factors which are the real requirement of consumers in the present era” [1]. Newer quality control measures are taking into account green technology in food production.

Problems

There are currently many parameters unaccounted for in cold storage systems: Changes in these parameters may cause fruits and vegetables to lose quality [2]
The parameters include:

1. Fluctuations in temperature
2. Changes in humidity
3. Change in pressure
4. Changes in CO₂ levels

If these parameters vary, this can create problems for food producers. When investigation by organizations such HACCP and FDA take place, deficiencies in these parameters result in food producers not adhering to regulations.

Solutions

- Wireless Sensor Network is a technology that would help solve these problems
- There are two ways by which information can be sent:
  1. Bluetooth - which can send large amounts of data rate (up to 1 Mbps within a 10 meter range).
  2. the ZigBee - which sends low amount of data rate over a low frequency bandwidth (up to 250 kbps).

Figure 1: Schematics of how WSN works [3]

Evaluation

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<th>WSN Requisites</th>
<th>Zigbee protocol features</th>
<th>Analyses</th>
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<tr>
<td>Energy Management</td>
<td>Sleep Mode, Polling Request</td>
<td>Considerable reduction in energy consumption of devices with verification of communication requests and standby operation mode</td>
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<td>Self-Organisation</td>
<td>Routing, AODV, Network Formation, Network Discovery, Network Joining</td>
<td>Satisfactory management of devices input and output on the network, with automatic creation of networks, topology and communication routes; Possibility of automatic node discovery in network coverage.</td>
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<td>Reliability</td>
<td>AES 128 bits and network authentication, ACK confirmation</td>
<td>Satisfactory encryption feature along with device authentication for secure communication and confirmation of message transmission; Limitation for applications with high-speed node mobility</td>
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<td>Node Independence</td>
<td>Coordinator node dependence</td>
<td>Network management functions are exclusive for Zigbee Coordinator (ZC); ZC dependency bypassed with the use of mobile sink (ZC) in WSN;</td>
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<td>Interoperability</td>
<td>International standard, Worldwide acceptance</td>
<td>Standard layers and functions provide flexibility and interoperability of equipment</td>
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Figure 2: Flow chart depicting the working of sensor nodes [3]

Figure 3: Comparison between wireless LAN, Bluetooth and ZigBee [4]

Figure 4: Overview of Feasibility Analysis of the ZigBee Protocol Application in WDSNs [5] (Adapted)

References