Food Sustainability Using Wireless Sensors Networks: Waspmote and Meshlium

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Abstract- **In recent years much of the attention has been attracted by the Wireless Sensor Networks (WSNs) with immense applications that are used for collecting, sharing and storing the sensed data. They are increasingly being applied to wide variety of applications including habitat monitoring, agriculture, nuclear reactor control and security. The Wireless Sensor Networks used in this paper for use in food sustainability at each stage of the food cycle. Libelium's Waspmote and Meshlium sensors are used for sensing and taking control decisions based on real time data of climatologically and other environmental properties to modify them.**

Keywords—GPS/GPRS, Libelium Waspmote and Meshlium Wirlss Sensor Networks, RFID, Waspmote Agriculture Board, ZigBee.

I. INTRODUCTION

"Food Security " refers to a state at all times , in which all people having reliable , physical and economic access to sufficient , safe quantity of affordable and nutritious food to meet their dietary preferences for an active and healthy life , whereas food security is declined dramatically in many developing countries. As food security is built on basic three pillars:

a) Food Availability: Food available in quantity that is sufficient on consistent basis.

b) Food Access: To acquire and procure the food of good quality is an assured ability in a socially acceptable way.

c) Food Use: Appropriate usage of knowledge about the basic nutrition and care, as well as on adequate water and sanitation.

Food Insecurity is the most broadly used measure of food deprivation in more of the developing countries. "At times during the year", due to lack of other resources and money it becomes very limited to access the adequate food, consistently. From each stage of food cycle i.e. from production of food to harvesting, during transportation to distribution, from consumption to management to bio-waste outputs [9], we require such food system that is reliable to prevent the food insecurity. To control and monitor the whole food cycle Libelium's Waspmote and Meshlium sensors are used [2].

Across the globe, major development problem that usually effects to developing countries in undermining people's health, productivity and in survival is food insecurity as it has emerged as crises on global economic meltdown. To protect and enhance the food sustainability the use of Waspmote sensors are assisting and encouraged by many project applications across Europe.

II. FOOD PRODUCTION

Today production of food is one of the major sectors included in the frame of global security. Enhancing the food sustainability, Waspmote sensors networks are used to maintain crop cultivation capacity throughout the production cycle [1]. Meteorological factors such as humidity, temperature and light, frost risk can be detected by combining these sensors. Prevention can be ensured by monitoring basic requirements and diseases of plants and measures the delicacy of crops, vineyards and tropical fruits that are affected most where there is slightest change in environment.

II.1 WASPMOTE WIRELESS SENSORS

Waspmote is a sensor device that works with different protocols (ZigBee, Bluetooth, and GPRS) and capable of getting frequency links up to 12 km [1]. One of the main characteristics of it is low power consumption i.e. (9mA-ON mode, 62µA-sleep mode, 0.7µA- hibernate mode). Different parameters that can be measurable by the use of waspmotes are:

- Ambient Temperature.
- Atmospheric pressure.
- Moisture and temperature of soil.
- Radiations like ultraviolet, solar.
- Leaf wetness.

Fig: 1 Waspmote Sensor Device

II.2 WASPMOTE AGRICULTURE SENSOR BOARD

It consists of electronics, required for the hardware integration implementation of those sensors that are connected to waspmotes through this sensor board. It monitors the multiple environmental parameters ranges applications from development analysis to whether observation. This monitoring system can also be used in the reduction of intensities of resources and requirement of labors on site during the growth stage of food. At crucial stages of food production phase, the crop cultivation systems are automatically based upon reading of sensors and parameters for each crop can be defined in advance. For collective management of crops the agriculture board work together to maximize and protect or sustain crop cultivation in urban settings.
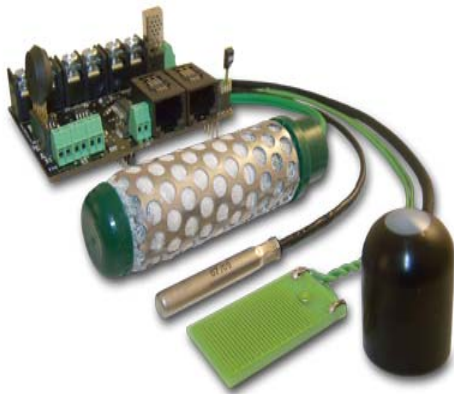

Fig: 2 Waspmote Agriculture Board

II.3 MESHLIUM

Meshlium is Linux router which acts as a Gateway to the waspmote sensor networks, consists of radio interfaces of five different types: WIFI 2.4 GHz, WIFI 5 GHz, 3 G/GPRS, Bluetooth and ZigBee. It is multi-protocol router that collects all the relevant information from the sensors nodes and leaving them in the cloud. In order to deliver accurate position and time information, GPS module is integrated by Meshlium in order to know where this each router is located. Along with storage options of the sensor, Data received these configurations such as WIFI. ZigBee, Bluetooth and 3G/GPRS can easily and quickly control with the web application, Manager System which comes with Meshlium.

Using ZigBee radio, Meshlium receives the sensor data sent by waspmote and possible actions can be performed [3]:

- Sensor data is stored in the Meshlium local database (MySQL).
- In the External database (MySQL) ZigBee sensor data is stored.
- Information is send using Ethernet or WIFI connection to internet.
- The information is send using 3G/GPRS connection to the internet.

III. FOOD DISTRIBUTION

Transportation of food from supplier to consumers refers to food distribution and protecting the produce during transportation is one of the important aspects of the food distribution process. (GPS, Sensors and clock) are the technologies that are integrated possibly to control the real time conditions. During the transportation of product, environmental samples are stored and detected by the waspmote to know about the explosion, dampness in high temperatures and about the contamination during the journey. GPS and GPRS/3G modules that are incorporated in waspmote provides detailed information about the condition of food being transported   and can be located at all times. This leads to improve and enhance the product traceability and towards the determining liability when it gets spoiled during the logistics phase.
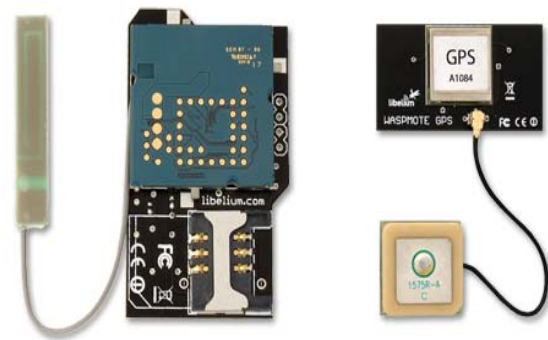

Fig: 3 Waspmote GPS and GPRS/3G modules

IV. FOOD CONSUMPTION

On merchandise containers Waspmote can operate as a smart label. Number of units, batches and product information in a wireless fashion can be transmitting through ZigBee (a radio interface that yields the low latency and high throughput for devices like sensors and controls) [3].

For the detection of expiry food or to alert a client about no consumable food waspmote RFID module can be used. RFID (Radio Frequency Identification) is a technology used for the identification of objects in contactless way with use of electromagnetic fields, also known as proximity identification [8].

Fig: 4 Waspmote RFID module

V. BIO WASTE AND DISPOSABLE MANAGEMENT.

Food waste can be a source of contamination and disease in high temperature, humid day and in severe weather events. Globally many of the developing nations struggle with spoilage, as food waste rising 50 percent [11]. Many of the following industries are aggressively pursuing for changing patterns of waste disposal to achieve the goal of sustainable food service.

To ensure that levels of contamination remain safe in high risks and in high density areas, the disposable wastage can be monitored by using the waspmote sensors and ensures that wastage sources are not vectors for disease or contagion.

VI. CONCLUSION

To improve efficiencies, better informing consumers and to reduce risk at each stage of the food sustainability cycle, Libelium's technologies such as waspmote and Meshlium are used. Improvements for customers to participating in food cycle for civic authorities and industries to ensure food security for everyone with use of increasingly limited resources are offered by Libelium's technologies.

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