

Monitoring Maximum Duration of Storage of Yellow Banana in Control RH% Using Wireless Sensor Network



Engineering

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ABSTRACT

Wireless sensor network (WSN) capable to manage multi-distributed information like temperature, air flow, moisture, condensation and concentration of volatile compounds, allow intercommunication with further accessible stations, and perform intelligent control of the cooling system.

The aim of this paper explores the potential of wireless sensor technology for monitoring banana storage conditions. Fruits and vegetables are submitted to a variety of risks during transport and storage that are responsible for material quality losses. Among them are intrinsic chemical processes that fresh products undergo after harvest. This paper indicates effort to monitor banana quality in control RH% with relevant sensors and find maximum duration of storage for yellow banana in this condition.

INTRODUCTION

Fruits and vegetables are submitted to a variety of risks during transport and storage that are responsible for material quality losses. Among them are intrinsic biological and chemical processes that fresh produce undergoes after harvest, related to a lack of appropriate control on duration, temperature and humidity, which causes senescence and rot. As a consequence, effective cold-logistics monitoring is fundamental for ensuring product quality along the supply chain [1].

Fruit products are commonly produced by small scale rural producers as the technologies are relatively simple and producers are often close to the source of supply. The main quality factors associated with fruit products are the characteristic flavor and color of the fruit, the absence of contamination, and in some products, a characteristic texture. However few quality characteristics of fruit products can be measured objectively and fewer still can be measured by machines.

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, gas, pressure, humidity etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. The use of wireless intelligent sensors inside refrigerated vehicles was proposed in 2004 by Qingshan et al. (2004). Subsequently [7]; tested a RF device in a metal cargo container and demonstrated that it is possible to communicate with the outside world. Craddock and

Stansfield (2005) proposed sensor fusion for the development of smart containers in order to improve security, gathering data from several sources in order to trigger the alarms. Containers may incorporate a variety of sensors to detect, identify, log and communicate what happens during their journeys around the world. Jedermann et al. (2006) presented a system for intelligent containers combining wireless sensor networks and RFID (Radio Frequency Identification). Ruiz-Garcia et al.

The project described here aims at improving the quality of the overall winemaking process by using an innovative infrastructure based on Wireless Sensor Networks [10, 11]. The present project proposes a real-time, pervasive, non-intrusive, low-cost, and highly flexible data analysis methodology, and WSNs appear to fit this goal. Many applications are reported in literature that describe projects where wireless sensor networks have been applied to habitat monitoring, such as in the case of the famous Great Duck Is land project [3]; more recently, WSNs have also

been employed in the more specific area of farming monitoring and a few preliminary works describe applications for precision agriculture [3, 4, 5]. Banana is the most important fruit in international trade..

Material and method

Crossbow Sensor networks become long-lived, easily deployed, and resilient to the unpredictable wireless channel.

2.1. Moteview software is used in this experiment .Mote View supports all of Crossbow's sensor and data acquisition boards as well as the MICA2, MICA2DOT, and MICAz processor/radio platforms. In addition, MoteView can be used to deploy and monitor sensor integrated platforms such as the MSP Mote security/intrusion detection system and the MEP Mote environmental monitoring system. The motes are programmed with xmesh /tinyos firmware (application)to do specific task. TinyOS supports microprocessors ranging from 8-bit architectures with as little as 2 KB of RAM to 32-bit processors with 32 MB of RAM or more. It provides a well-defined set of APIs for application programming. These APIs provide access to the computing capabilities of the sensor node, allowing for intelligence within the network. Using these capabilities, sensor data can be preprocessed on the node, optimizing both network throughput and battery life by avoiding unnecessary send and receive messages. The MIB520CB provides USB connectivity to the IRIS and MICA family of Motes for communication and in-system programming. The IRIS is the latest generation of Motes from Crossbow Technology. Any IRIS/ MICAz/MICA2 node can function as a base station when mated to the MIB520CB USB interface board. In addition to data transfer, the MIB520CB also provides a USB programming interface. The MIB520CB offers two separate ports: one dedicated to in-system Mote programming and a second for data communication over USB.The MIB520CB has an on-board processor that programs Mote Processor Radio Boards. USB Bus power eliminates the need for an external power source. Specifications USB Interface

- **Baud Rate: 57.6 K**
- **Male to Female USB cable**

Base station MIB520 USB Gateway provides USB connectivity to the IRIS and MICA family of Motes for communication and in-system programming. It supplies power to the devices through USB bus. . The IRIS, MICAz and MICA2 Motes connect to the MIB520 for UISP programming from USB connected host PC. The radio used by the IRIS is an IEEE 802.15.4 compliant RF transceiver designed for low-power and low-voltage wireless applications. It uses Atmel's AT86RF230 radio that employs O-QPSK ("offset quadrature phase shift keying") with half sine pulse shaping. The 802.15.4 radio includes a DSSS (digital direct sequence spread spectrum) baseband modem providing a spreading gain of 9 dB and an effective data rate of 250 kbps. The radio is a highly integrated solution for wireless communi-

cation in the 2.4 GHz unlicensed ISM band.

Experiments

The experience was conducted in order to measuring different in range of humidity and temperature in two separate environments on banana.

To understanding the extent of range and effect of different environment and also to find out the best environment for keeping bananas, this experience have been done on 10 bananas that five of them kept in to a box with cab and another five bananas kept in the room environment.

Each day temperature and humidity was measured for 8 hours in first and 14 hours in second and third day. This experiment was carried out for 3 days and humidity inside the box kept constant between 85-95%.

Yellow bananas	30-33°C	90 - 95%	3 days
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Results and discussion

In this research work, 5 bananas were kept into box and 5 banana kept outside the box in room temperature and humidity. In the first day temperature was between 30-31.6c outside and 32-33c inside the box and humidity was in the range of 26 to38% outside the box and kept constant between 85-95% inside the box . Figure 1.1 shows the temperature change on each day of experiment over 3 days period inside the box and figure 1.2 shows the temperature change on each day of experiment over 3 days period outside the box. Fig 2.1 shows humidity change on each day of experiment over 3 days period outside the box and Fig 2.2 shows the humidity constant between 85-95% inside the box.

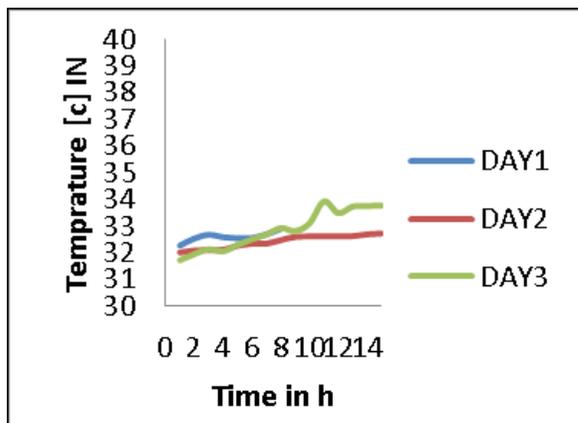


Fig 1.1 Temperature change over 3 days inside the box

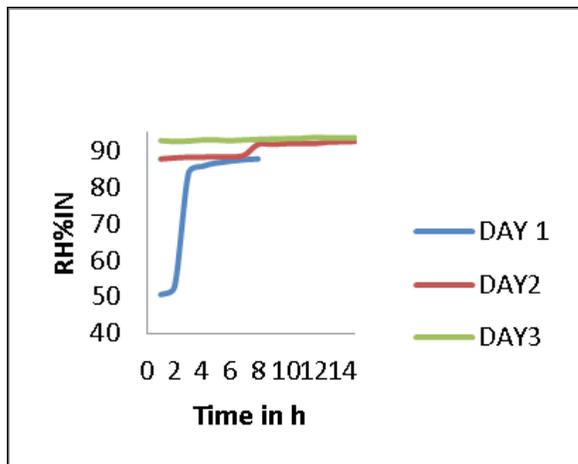


Fig 2.2.Humidity constant inside the box

Fig1.2

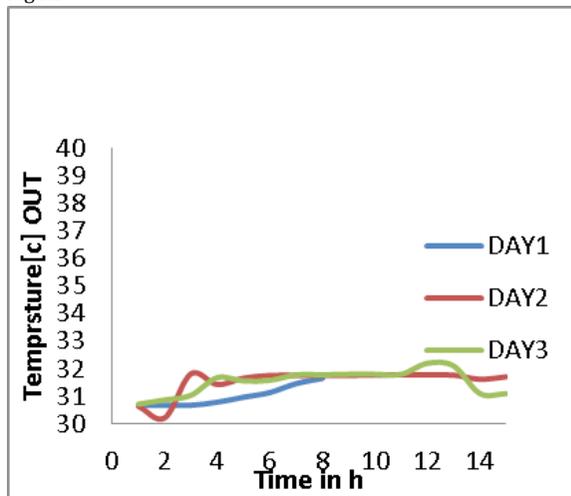


Fig1.2 Temperature change over 3 days inside the box

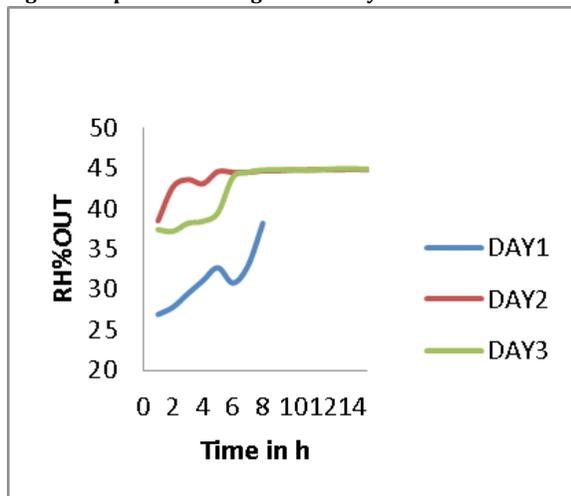


Fig 2.1. Humidity change over 3 days outside

When there is exchange of temperature with outside of box and humidity was increased between 85% to 95% so process of spotting on bananas skin was faster with compare out site of the box. On 3th day all bananas were removed from the box and out site of box were cut, and internal decay in bananas was observed. In the third day of experiment those bananas that placed outside the box and in the room environment in compare to second day had not any change on skin and quality. . Fig 3 shows the picture of banana on day one. . After removing bananas from the box on third day , In Fig 4.1 it has been observed that process of spotting on bananas skin was faster with compare out site of the box as shows in Fig 4.2 .In Fig 5 shows internal decay in banana on day three.



Fig 3. Banana on day one



Fig 4.1 Banana on day three inside the box

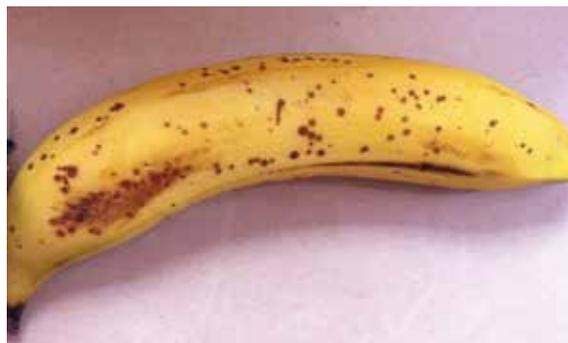


Fig 4.2 Banana on day three outside the box



Fig 5. Internal decay of Banana

As a matter of fact fruits like banana even after harvesting continue to ripen and they produce ethylene gas that causes further ripening of banana. Ethylene production rates in crops decreases when one or more of the following conditions exist:

1. the products are stored at the lowest safe temperature
2. Oxygen is reduces.
3. Carbon dioxide levels around the product are increased.

With refer to the experiment banana uses oxygen and release CO_2 then the oxygen level inside the box is reduced and the CO_2 level is increased as a result ethylene amount was not increased and follow that the banana peel was changed and bananas started to decay from inside when temperature was more than safe storage temperature

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