RADIO FREQUENCY PROPAGATION, CHARACTERIZATION AND MEASUREMENTS FOR ANTENNA SENSOR NETWORKS WITH APPLICATIONS IN SMART FARMING

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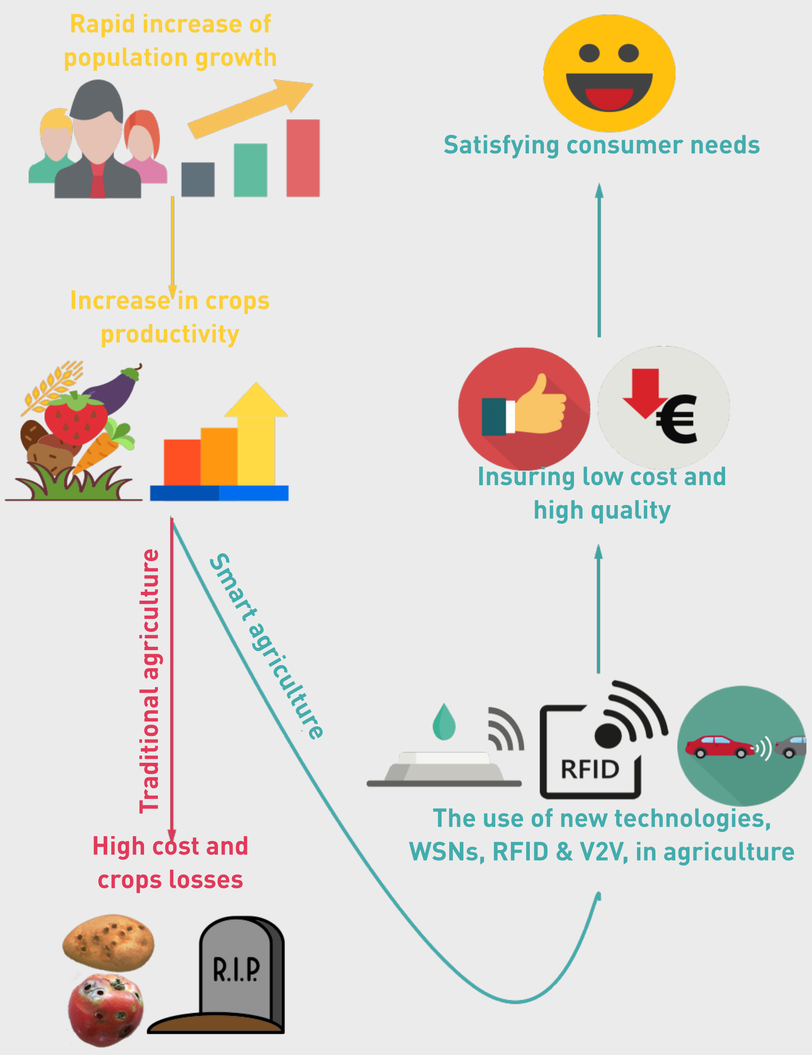
Motivation of the work



Thesis Objectives

Design and development of an ideal smart farming system for crops monitoring from cultivation to transport and storage in warehouses.

Research Plan

Finishing the radio frequency propagation measurements and analysis for WSNs and RFID technologies in agriculture fields and enviroments which has been started during the final year project internship in the University of Vigo.

Developing of radio channel models for improvement of V2X and WSN communications.

Searching requirements for a propagation simulation tool. Using full duplex communications for both WSN and V2X.

Developing a V2X protocol to improve long-distance and real-time traceability of food transportation.

Combining all developed applications in one responsive application for crops monitoring through all steps.

Next year planning

STEP 1: Improving current year results and publishing papers in International journals and conferences.

STEP 2: V2X technology art state and material gathering.

STEP 3: Applying IoT technologies & applications on smart farming for better efficiency.

References

[1] H. Klaina, A. V. Alejos and O. Aghzout "Radio frequency propagation study for near-ground antenna sensor networks dedicated to agriculture", submission pending.

[2] H. Klaina, A. V. Alejos and O. Aghzout "RFID Tags Detection Effects for Smart Agriculture Applications" submission pending.

[3] A. Boussaid, N. Alaoui, O. Aghzout, Y. Chakkour, A. V. Alejos and F. Falcone "Highly efficient error correcting codes for ubiquitous healthcare in Wireless Body Area Networks," 2016 International Conference on Electrical and Information Technologies (ICEIT), Tangiers, 2016, pp. 225-230.

[4] Y. Chakkour, H. Fernandez, L.Rubio, J.Reig, V. M. Podrigo and O. Aghzout "Experimental study of frequency dispersion of vehicular-to-vehicular propagation channel" APS/URSI 2017 .

[5] M I. Aslam and S.A. (Reza) Zekavat, New channel path loss model for near-ground antenna sensor networks. IET Wireless Sensor Systems, 2011.

Results & Discussions

The presented data are part of a paper

Hicham Klaina, Ana Vazquez Alejos and Otman Aghzout "Radio frequency propagation study for near-ground antenna sensor networks dedicated to agriculture" and is currently under review.

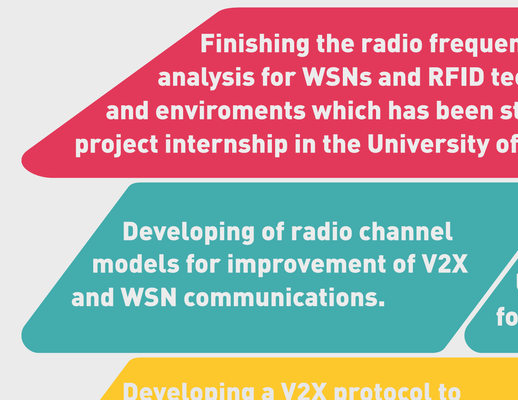
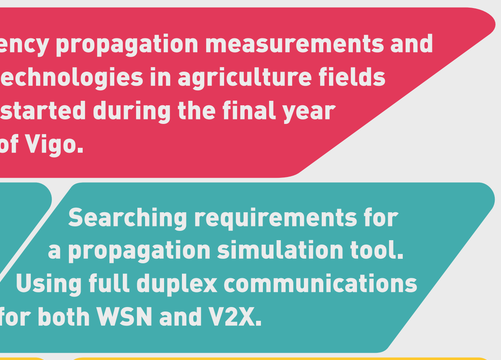


Fig 1. Path loss in agriculture fields at 2.4GHz for H1=20cm & H2=40cm.



Best Final Year Project Prize at the National School of Applied Sciences of Tetuan, Morocco. The presented researches are part of the project which has been done at for the UVigo.

Hicham Klaina, Ana Vazquez Alejos and Otman Aghzout "RFID Tags Detection Effects for Smart Agriculture Applications" and is currently under review.

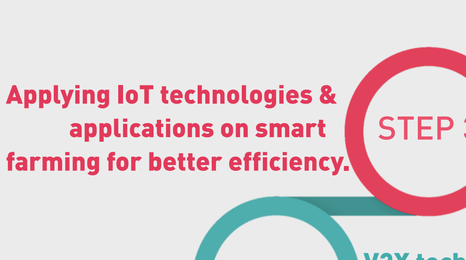
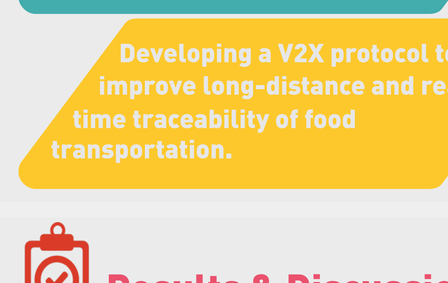


Fig 2. RSSI values using ALN G tag attached to a plastic bottle at 7cm from the bottom.



Measurements show that a significant change in path loss occurs when lowering the height of the antennas near to the ground after a break distance, changing the field (soil, short grass and tall grass field) and the radio frequency (868MHz, 2.4GHz and 5.8GHz).

In this experiment, we used two types of RFID tags attached to bottles of liquids & boxes of vegetables. Measurements demonstrate that RFID tags type, positioning and crop's dielectric constant have a big influence on tags detection performances.

Traceability of food transportation using Arduino Uno

Using this model, farmers or distribution company owners can trace their food transportation which is a part of the new V2X technology. The device can respond to farmer's number call or SMS only by sending an SMS contains a link of food transportation's place in real-time on Google Maps .

WSN for farm monitoring using Raspberry Pi 3 Model B

Using this WSN, farmer is allowed to monitor his farm in real time using his smartphone or laptop whenever and wherever he is. the example below is for real time temperature monitoring.