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Detection Identification and Tracking of Smart Homes using Bluetooth and WLAN

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Abstract— Advance in computing over the last decade have allowed us to be closer to the realization of true smart homes. To check our living surroundings and to observe ecological conditions such as temperature, dampness, brilliance and employment level power utilization, many sensors are entrenched. To achieve the primary goal of smart home must be able to identify and localize inside the home. The user detection and localization problem are the crucial challenges introduced by smart home problem. The move towards resolving these confronts is by practice of Bluetooth equipment for user recognition and trailing along with Wireless Local Area Network and Sensors which are progressive and stock up the entrances. The solution represents inexpensive and energy conserving methodology to solve the essential part of smart home problems.

Keywords— Smart Homes; Bluetooth Tracking, Sensors; Beacon; Localization.

1. Introduction

This vision is increasingly becoming a reality in the era of Internet Of Things [IOT] where more and more sensors are used in the environment to achieve our goal of making for daily life "smarter". One of the visions is the concept of smart home where we use different types of sensors which are used in homes. In order to achieve different goals like assisting elderly people and energy conservation. In this paper the home track the inhabitant's daily routine and get knowledge to make life at home more comfortable. Also power utilization to lessen environmental impact and conserve natural resources. The overall problem can be seen to consist of three constituents.

- Presence Detection: In this the system must be able to detect the presence.
- Presence Identification: The identity of the detected entity is examined.
- Presence Localization: It determines the exact position of the detected entity inside the monitored space.

Presence detection is the fundamental problem. The requirement for the design plan of our solution demanded both person identification and localization up to a resolution of room level. In section II it discuss about different types of sensors which are used in the smart homes for presence detection. It also describes the advantages and disadvantages of types of sensors.

2. Sensors for Presence Detection

Presence detection system can be realised with different types of sensors. Each types of sensors has its pros and cons.The following list presents the sensors.

2.1 Binary Sensors

These sensors have only two states i.e. presence is either detected or not. Examples, of them include contact sensors, break beams, Passive Infrared sensors (PIRs). Of these PIRs are the most popular, being cheap, passive and easy to program. They can also be used in array configuration to estimate position and number of people in the room. However, they face issue in detecting stationary people as their functioning hinges in movement, and Presence identification, while possible requires a huge amount of data processing.

2.2 Pressure Sensors

These include piezo-electric materials and strain gauges. They are a good way to achieve localization, but the number of those required to achieve presence detection over a whole room would prove to be prohibitive. Also, they lack person identification capabilities as well.

2.3 Chemo Sensors

Including sensors like Co2 sensors, humidity sensors etc. Chemo sensors are not suitable for our case because they are too slow in detecting presence in the environment.

A. Cameras

In this sort, we have CMOS picture sensors, CCD picture sensors, dedicated action or edge noticing imagers, micro bolometer arrays and PVDF (Polyvinylidene Fluoride) arrays. While these do provide person

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identification and localization and were viable options for implementation, it too suffers from problems of detecting stationary people after extended periods. Also, the overwhelming ethical qualms one associates with taping a person's complete life at home necessitated the search for more viable alternatives.

B. Ranging Sensors

This category contains ultrasonic range-finders, scanning range sensors like radars, sonar's etc. come under this category. While they work well for detecting stationary people, person identification remains an issue.

C. Inertial Sensors

These include accelerometers, gyroscopes, magnetometers etc. While viable, they would have to be combined with another type of detector to get rid of accumulated errors and thus serve better as secondary detectors to enhance resolution rather than standalone implementations.

D. Vibration Sensors

This includes seismic sensors, electrostatic microphones, laser microphones etc. The accuracy of the implementation after the amount of signal processing required extracting results and its use. Also, it too lacks person identification capabilities.

2.4 RFID Sensors

The best fit for the problem, provides person identification and localization with a resolution capability of room level and even better. The primary issue with its use is convenience. RFID tags will have to be ceaselessly accepted on individual all the time throughout ones association at home, and devoted RFID reader hardware will contain to infuse the house.

3. Bluetooth and WLAN

Both ubiquitous technologies, both unobtrusive, both low power and both easily available on a device that people tend to carry around everywhere with them, even at home – their mobile phone. Out of all possibilities studied, it was concluded use of one of these seemed the most viable option to satisfy the project goals and hence went about designing and implementing a system based on it. Bluetooth was chosen over Wi-Fi primarily because of lower drain on the mobile devices, and also since Bluetooth signals are weaker than Wi-Fi, better room level localization was achievable.

4. Existing System

In the existing system they use only the sensors but it created some problems in detection. In the earlier many years ago they used in smart home only the sensors but it didn't give much result while using it. While using sensors alone it was able to detect only what is present at the home and also there was high power consumption. The next enhancement of smart home was done by using some of the sensors like RFID, Pressure sensor, Chemo sensors, Vibration sensors, Binary sensors, Ranging sensors, Cameras and Bluetooth was connected and gave much better result than the existing system. But the problem found in this system was it can identify and detect the things present at home but the localization was not clearly found where these entities are present. When using Bluetooth it also gave the result of low power consumption.

5. Proposed System

In the proposed system they use the sensors like pressure sensors, ranging sensors, inertial sensors, etc., Bluetooth and Wireless LAN which can help to detect the things in the home. To overcome the existing problem in which localization is not achieved much. But, if we use the WLAN technology because Wireless LAN has high signal transmission when compared to Bluetooth. WLAN technology also has low power consumption since Bluetooth has weaker signal it cannot find out the localization in a correct manner. When we use WLAN and Bluetooth along with some of the sensors it found a solution for finding out the localization problem.

6. Methodology

To set up the Bluetooth Personal Area Network (PAN), for the beacons 3 powered USB hubs were used in combination with 3 Bluetooth USB sticks as shown in Figure (1), (2).

Fig.1: Bluetooth beacon

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It was decided against using Bluetooth headsets as while the hub-based implementation does cost marginally more, it has the advantage of requiring much less maintenance as there is no requirement to charge each Bluetooth beacon every couple of days, thus creating periods where the whole network has to be taken off-line. The only setup required is that initially, each USB stick has to be connected to a PC and made discoverable. After this was done, each USB has to be connected to a PC and made discoverable. After this was done , each beacon was then ready and setup in different room.

Fig.2: Bluetooth enabled handset

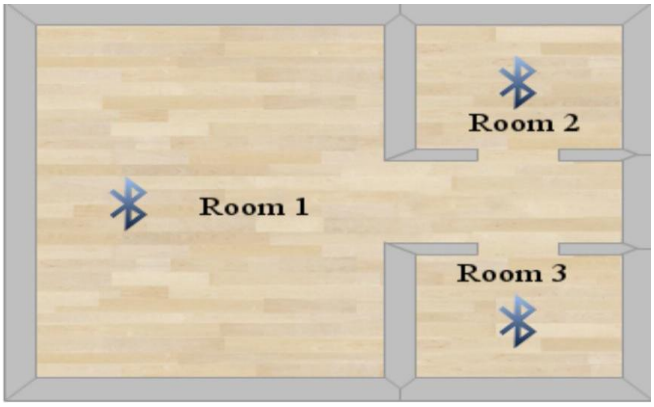

Fig. 3: Floor plan of the test bed

The mobile phone used in this experiment was a Motorola MB525 with Bluetooth v2.1 and Wi-Fi 802.11 b/g/n. It was programmed to periodically (every 30 seconds) run a Bluetooth discovery search and extract the values for the three known beacon. The 3 values and a time stamp were then transmitted to the home gateway over the wireless LAN. The home gateway then proceeded to perform localization and identification of the users in the test bed.

Wireless networks and sensors are seen to fool around an gradually more imperative role as key enablers in promising enveloping computing technologies that are necessary for recognition of smart homes. A top level building of smart home is exposed. It comprises a server/ gateway/ router that can be used as the focal point of connectivity for devices within the home as well as permits connectivity to the outside globe. The system also comprises smart sensors as well as machines that have either wired or wireless connectivity converses with the smart homes from the exterior can be done one or a mixture of the subsequent outside network such as phone lines, cable tv and control line networks.

Smart home can profit from Bluetooth tools in a diversity of conducts. One opportunity is to implant appliances with Bluetooth radio transceivers and employ that technology to communicate with a home server that is available by the consumer. These facilitate observing and control functions to be mannered by the consumer. Another probable submission is the establishments of Bluetooth facilitated sensor networks that can path the well being of populace with disabilities.

A principal anxiety of the use of Bluetooth is its safety susceptibility. A sensor is a tool that converts a physical or biological amount into electrical amount. The calculated electrical amount should be transformed to digital design. The smart sensors will have to purpose in a sovereign manner and preserve the solitude of the home residents.

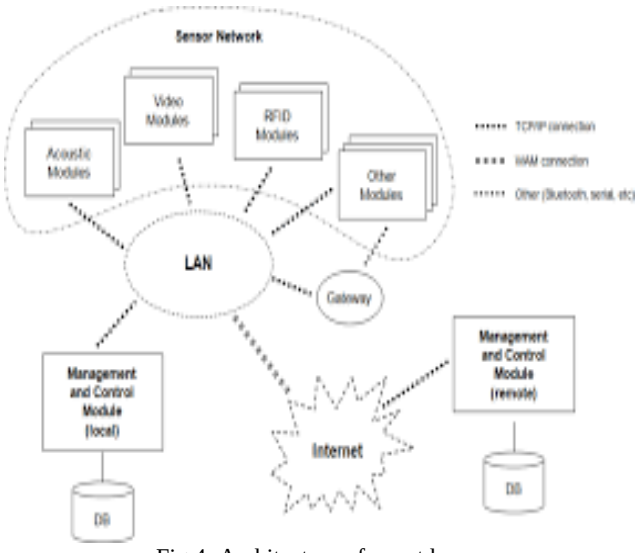

Fig.4: Architecture of smart home

7. Result

The structure functionality and services were experienced all the way through confirmation and justification at all stages. These procedures comprise the distant observing and controlling devices / appliance at the residence. The refuge features execute to protect the communication among the residence servers.

The result of this paper is that home entities are connected with Bluetooth alone there was localization problem but if it is connected with Bluetooth and Wireless LAN the problem will be solved easily.

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In the below diagram it shows the home entities consumption and also the status whether the device is on the on state or off state. It can help out by monitoring our all devices which are situated in our home and we might come to know their power consumption and energy efficiency.

Fig.5: Room temperature

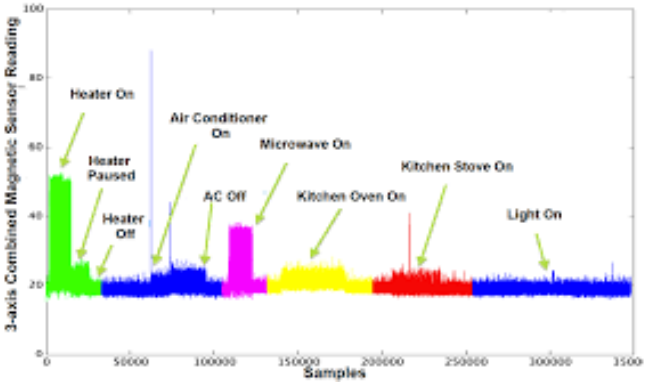

Fig.6: All entities on/off state

8. Conclusion

In this paper I have conceptualized and implemented a low- power, cheap and unobtrusive Bluetooth based presence detection, localization and identification system that requires extremely low maintenance using common, every day items to use in the smart homes of tomorrow. In this paper it shows that a solution based on Bluetooth technology was the most viable option to satisfy the goals of this project and hence went about designing and implementing a system based on it. Bluetooth was chosen over WLAN primarily because of lower power drain on the mobile devices, and also since Bluetooth signals are weaker than WLAN, better room level localization can be achievable and also provide 100% accuracy and prediction for room level localization.

References

[1] G. Miklos et al., "Performance Aspects of Bluetooth Scatternet Formation," poster presentation at Mobile Ad Hoc Networks and Computing (MobiHOC 2000), IEEE/ACM workshop, Aug. 2000, pp.456-457.

[2] T. Salonidis et al., "Distributed Topology Construction of Bluetooth Personal Area Networks," Proc. IEEE Infocom 2001, IEEE Communication Society, New York, Vol.4, 2001, pp.36-40.

[3] J.Desbonnet and P.M. Corcoran, "System Architecture and Implementation of a CEBus/Internet Gateway, "IEEE Trans On Consumer Electronics, Vol.43, No 4, Nov 1997, pp.987-992.

[4] T.Saito, et al., "Home Network and Home Gateway Architecture Considering Digital Appliances and Its Implementation", IEEE Trans on Consumer Electronics. Vol. 46, Issue 4, November 2000, pp.1161-1166.

[5] D.Valtchev, I. Frankov, "Service Gateway Architecture for a Smart Home". ECHONET www.echonet.com BBC NEWS: Music trial taps into Bluetooth. http://news.bbc.co.uk/1/ hi/technology/ 4392534.stm.

[6] A. Beaufour, M. Leopold, and P. Bonne, "Smart-Tag Based Data Dissemination", In WSNA'02, Atlanta, Georgia, Bluetooth SIG. Bluetooth Specification , Vol.2, 2004, pp.765.

[7] V. Bychkovsky, B. Hull, A. K. Miu, H. Balakrishnan, and S. Madden, "A Measurement Study of Vehicular Internet Access Using in Situ Wi-Fi Networks", MobiCom'06, Los Angeles, CA, September 2006 pp.789-799.

[8] J.-C. Cano, J.-M. Cano, E. Gonzalez, C. Calafate, and P. Manzoni, "Power Characterization of a Bluetooth-based Wireless Node for Ubiquitous Computing", ICWMC'06, Bucharest, Romania, July 2006, pp.654-968.

[9] Aswin Castro .B.U and Rajesh. M, "Bluetooth Enhancement in Data Transmission", Special Issue of Engineering and Scientific International Journal, Technical Seminar & Report Writing - Master of Computer Applications - S. A. Engineering College, May 2015, PP.5-8.

[10] C. Drula, C. Amza, F. Rousseau, , and A. Duda, "Adaptive Energy Con- ˇ serving Algorithms for Neighbor Discovery in Opportunistic Bluetooth Networks", IEEE JSAC, Vol. 251, January 2007, pp.96–107.