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Green Intelli Campus Using Radio Frequency Technology

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Abstract

To strategically reduce the carbon foot print of a chosen campus using RFID tags to monitor and manage the daily energy consumption pattern of the campus. In today's world, the need of the hour is to reduce the carbon foot print (CFP) in our day to day activities since higher carbon foot print means more global warming and green house gas (GHG) accumulation over a period of time. From fossil fuels to bio fuel/solar and wind, from public transport to sustainable metro transit grid, from a dream home to dream community and from a energy intense campus to a green and eco friendly campus. As one can see today many educational institutions have campuses which have activities which are isolated in terms of communication with its members. The objective of this proposal is to bring a sustainable integrated eco system model through innovative and CFP reducing processes. To work on this model an intelligent communication channel is established the efficiency of the campus and its potential is increased exponentially through a dynamic bi-directional feedback system. The system proposed here is perhaps affordable, accessible and adaptable and can be applied to about 5k – 10k population in an 8 hour cycle. The purpose is that an established system gives a constant feedback to each of its members on various multifarious activities. When a member of the campus wearing the RFID tag enters the campus, the person is immediately updated of the day's events via a text message. The same applies for when the student walks into a specific department. However in these systems the reliability and confidentiality and the management of the database is critical. By incorporating cycling and validating and sustaining it through an automated system the use of fossil fuel based locomotives can be greatly reduced. Further validation can be done by RFID tags coupled with sensors of high precision and accuracy and reproductively. The number of hours a student logs in for reducing the carbon credit will also be acknowledged. All this can be done using the CCRA (Carbon credit reducing algorithm) which is explained in the following sections.

Keywords: RFID, carbon credit, carbon foot print, embedded system.

Introduction

Reducing carbon credit!: In today's world, the need of the hour is to reduce the carbon foot print (CFP)[1] in our day to day activities since higher carbon foot print means more global warming and green house gas (GHG) accumulation over a period of time. There are more than 300 universities and over 45,000 colleges (campuses) in India. The carbon footprint generated from these campuses contributes largely to the overall carbon footprint of the country. The green house gas emissions from fossil fuel vehicles and student activity pattern in the campus are huge and this is where the model can make a major difference. Hardly few campuses are environment friendly taking into account their daily carbon footprint activity. Since many campuses have students, by monitoring the activities of students we can reduce the carbon footprint with a constant feedback analysis operation[2].

Purpose and Detailed description of the proposed solution: The solution lies in making the campus alive and creating a bi-directional communication channel between the student and the campus through RFID thereby supporting each other to have a more environment friendly campus where movement is minimized. In most of the campuses students are given a smart card which contains a micro-chip embedded in it. Our solution would outsmart the smart cards with affordable RFID tags, the latest trend in technology. By using radio frequency identification mobility is enhanced. RFID sensors throughout the campus monitor the activities of students and record it in a database so that the movement to performance gain is optimized. Today, Fossil fuel vehicles are also coupled with a RFID tags and monitored. Excessive use of fossil locomotives results in a warning sent to the user via a text message. On-campus cycles are also RFID enabled. Using more of green energy vehicles in the campus enables the users to get certain incentives such as cycling around and even can be credited to their individual carbon credit. If a student is unnecessarily contributing to the carbon footprint, then the person gets a warning text and email with statistics of where and how they have contributed to the carbon footprint. At the end of every month an e-carbon card is setup and sent to all users and the ones with minimum ICC are identified and given recognition through various means. Real time RFID tracking also helps in virtually seeing where students are losing time and student activity pattern analysis would help not only in the ICC monitoring but perhaps in community carbon credit (3C).

Purpose of the developed solution: The purpose of the developed solution is to replace passive smart cards with active RFID tags which can be worn as a piece of clothing or pasted on

a bag. While activating the users logs when the user enters the campus all he/she has to do is just walk into the campus and the presence of a particular user is automatically felt as opposed to physically insert a smart card at the terminal every time the user enters and exits the campus thus avoiding impersonification. The major advantage of RFID tags are its reduced cost as shown in figure 2.

Figure-1
Reducing Carbon Credit

Material and Methods

The product comprises of two very simple gadgets implemented in large numbers viz. RFID tags[3] and RFID readers but the strategy is not so simple as explained below.

RFID tags which associates its unique identification number with a particular user and many sensors for real time validation of multiple readers which come under its umbrella/proximity. All sensors will be attached to a distributed computing system which will keep logging the events of the users in real – time and providing useful statistics about the rate of accumulation of carbon credit of each user so that the system can contribute maximum for minimizing the carbon credit. The java application[4] developed houses exception handling techniques for failure of a particular system so that redundant systems can take over and provide continued service.

CCRA - Carbon Credit Reducing Algorithm (Prototype) – Beta Version: The following algorithm describes how an event like generating a text message is done by a RFID system. RFID (radio frequency identification) systems use data strings stored inside RFID tags or transponders to uniquely identify people or objects when they are scanned by an RFID reader. In the following case, phidget RFID readers (p/n 1023) are used and these identify the RFID tags that are brought in close proximity to the reader and return the tag identification number using the EM4102 protocol[5]. The phidget RFID reader is connected to the USB interface of a desktop/laptop via which there is a bidirectional exchange of information and commands. The linking of the reader via the USB port, the activation of the reader and the extraction of the Tag ID is done with the help of the libPhidget Package which is embedded in the user Java program. Initially the program checks all the USB ports of the system to find the presence of an RFID reader. The wait for attachment method is called to wait for the reader to become available and it blocks up to a certain timeout. Failure of attachment of the device results in an exception being thrown. Upon successful attachment of the device, the Reader is activated and a simple LED helps establish this. Parallel to it the antenna of the reader is switched on to detect nearby RFID tags. When the antenna detects a new RFID tag in its range, it accesses the data string stored in the RFID tag and along with the identification ID sends it to the system. At this stage add tag gain listener (tag gain listener) is called and it adds a tag gained listener. The event is only fired one time for a new tag, so the tag has to be removed and then replaced before another tag gained event will fire. There is no limit on the number of tag gained change handlers that can be registered for a particular Reader.

In this method additional user defined events are executed which sends the reader serial ID and tag ID and sends it to the RFID database. In the database an appropriate event string is generated on knowing the serial ID of the reader and it assigned to the string to be sent as the text message. On addition to this the Tag Id detected is compared to the records of the database and on finding the matching user a text message is sent to his mobile device. The message sending is done in addition to a mail being sent to his email ID by way2sms services. Direct message services can be easily implemented by other paid services. On successfully sending the message the 'message sent' signal is registered in the database and is actively made visible on the console. Once the current RFID tag moves out of the range of the reader the add tag loss listener (tag loss listener) method is initialised. It adds a tag lost listener and there is no limit on the number of tag lost change handlers that can be registered for a particular reader. In case of any errors in the above processes add error listener method is initialised and it adds an error listener. The error handler is a method that will be called when an asynchronous error occurs. Finally an input of '0' is given in the console to shut down the Reader and bring an end to the whole process.

The embedded innovation curve[6] pictorially represents the life cycle model of creating an entirely new embedded system until future enhancements. The first three steps viz the launch, proof of concept and scaling requires tremendous amount of Input along with PUSH factor. When it reaches the threshold of a breakthrough the curve changes it characteristics. Now we slowly start getting value oriented results which has to pull accordingly and continuous improvement would prevail.

Results and Discussion

This system was implemented using three volunteer candidates in out college using real – time RFID tracking to monitor their daily activity patterns for a month. The values plotted are average values which were taken over a month. The first graph shows the activity pattern of the first month.