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C-BRIG: A Network Architecture for Real-Time Information Exchange in Smart and Connected Campuses

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Presented at

The 2017 International Conference
of Information Engineering (ICIE'17)

World Congress on Engineering
(WCE 2017)

London, United Kingdom

5th July, 2017.

Introduction

- Education at all levels is one of the ***major driver of sustainable development*** in any nation [1].
 - Institutions of higher learning has a critical role to play in the realization of a sustainable development in any nation, most especially developing countries [2].
- In this way, ***education*** and ***skill acquisition*** are central to the process of development.

Introduction (*Cont'd*)

- The number of institutions of higher learning and enrollment in Africa *has continued to increase significantly* over the last few years.
- However, the needs of the *knowledge society* is still yet to be met due to challenges of:
 - *Overcrowding;*
 - *Infrastructure deficiencies; and*
 - *Inadequate access to international knowledge.*

Introduction (*Cont'd*)

- Seamless and effective communication of useful information will enhance administrative flow, boost academic and research productivity, and stimulate social interactions within and outside the university community.
- Universities in Africa can leverage existing modern Information and Communication Technologies (ICTs) to provide interactive learning, uninterrupted audio and video transmission, and recording and uploading of lectures and achieve smart education [7].

Introduction *(Cont'd)*

- High proliferation of smart devices and advances in mobile communication technology make electronic learning (e-learning) and mobile learning (m-learning) suitable for virtual classrooms and virtual meetings in a university environment [8].
- This technology can equally be adapted for administrative functions to facilitate timeliness, transparency, accountability, and reliability.

Research Aim

- In this research, the problem of communication access was identified for urgent attention as both intra-communication and inter-communication among institutions of higher learning in Nigeria are done through conventional means that are usually inefficient.
- Although several frameworks for learning environment exist [9-12], they do not adequately considered the peculiar nature of the operating environments in developing countries

Proposed Network Architecture

- A robust network architecture, Campus Bridge Information Grid (C-BRIG), was developed to enable real-time information exchange within and among connected campuses using connections of local networks and mobile applications.
- C-BRIG is a novel initiative that meets the information and social needs of staff, faculty, and students of tertiary institutions in developing nations.

Proposed Network Architecture

- C-BRIG is a communication network architecture that *facilitates digital transformation* of academic, research, administrative, and social events and activities with ***the use of mobile applications***.
- The mobile application has a number of general features which are accessible to all users. However, some features are restricted to certain category of users as related to the classes of people in a university community.

Features of C-BRIG

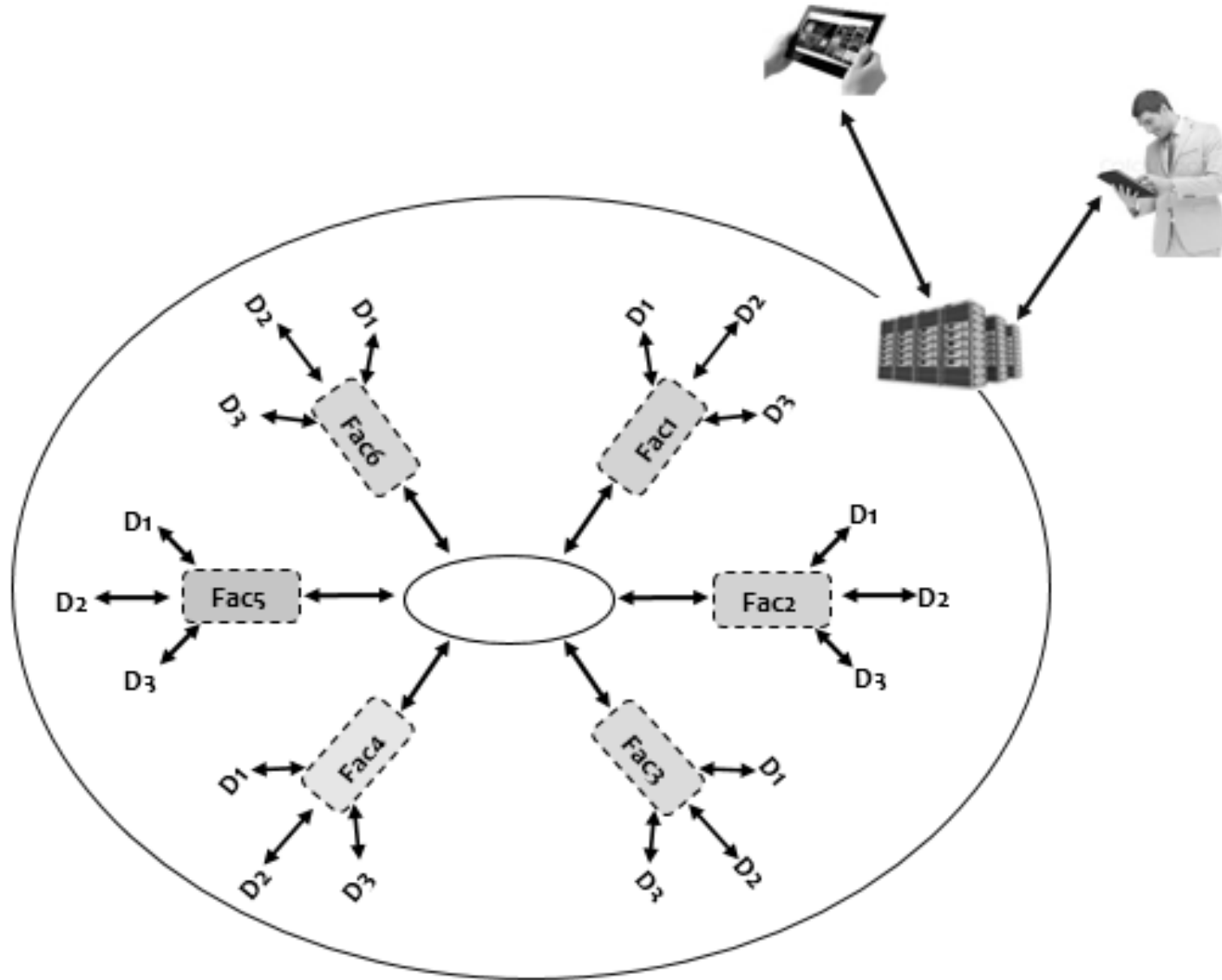


Figure 1: Conceptual Framework of C-BRIG

Features of C-BRIG (*Cont'd*)

- The specific features include:
 - virtual Dashboard (vD);
 - virtual Conference Room (vCR);
 - virtual Library (vL);
 - virtual Personal Wallet (vPW);
 - virtual Staff Office (vS);
 - virtual Lecture Theatre (vLT); and
 - virtual Hangout Spot (vHS).

Features of C-BRIG (*Cont'd*)

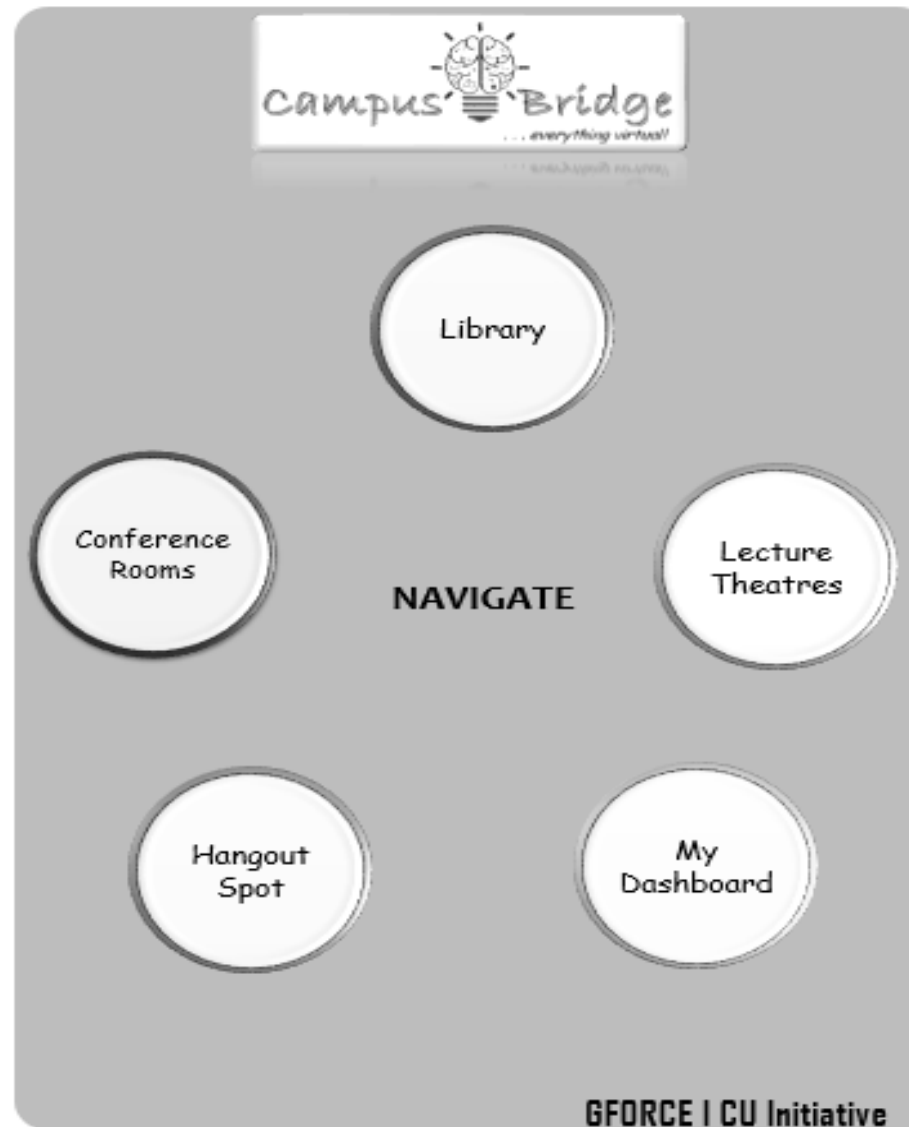


Figure 2: Mobile Application Dashboard

Features of C-BRIG *(Cont'd)*

- The vD facilitates seamless dissemination of information from the university management to all faculty, staff and students in real-time.
- With this feature, top management staff, the office of the registrar, administrative officers, and faculty heads can easily reach the entire faculty, staff and students from the convenience of their offices, at any given time or day of the week.

Features of C-BRIG (*Cont'd*)

- The vCR is a virtual room where faculty and staff across colleges confer with the aid of several audio-visual tools. This feature ensures that real-time conference sessions can hold irrespective of physical distance barriers.

Features of C-BRIG (*Cont'd*)

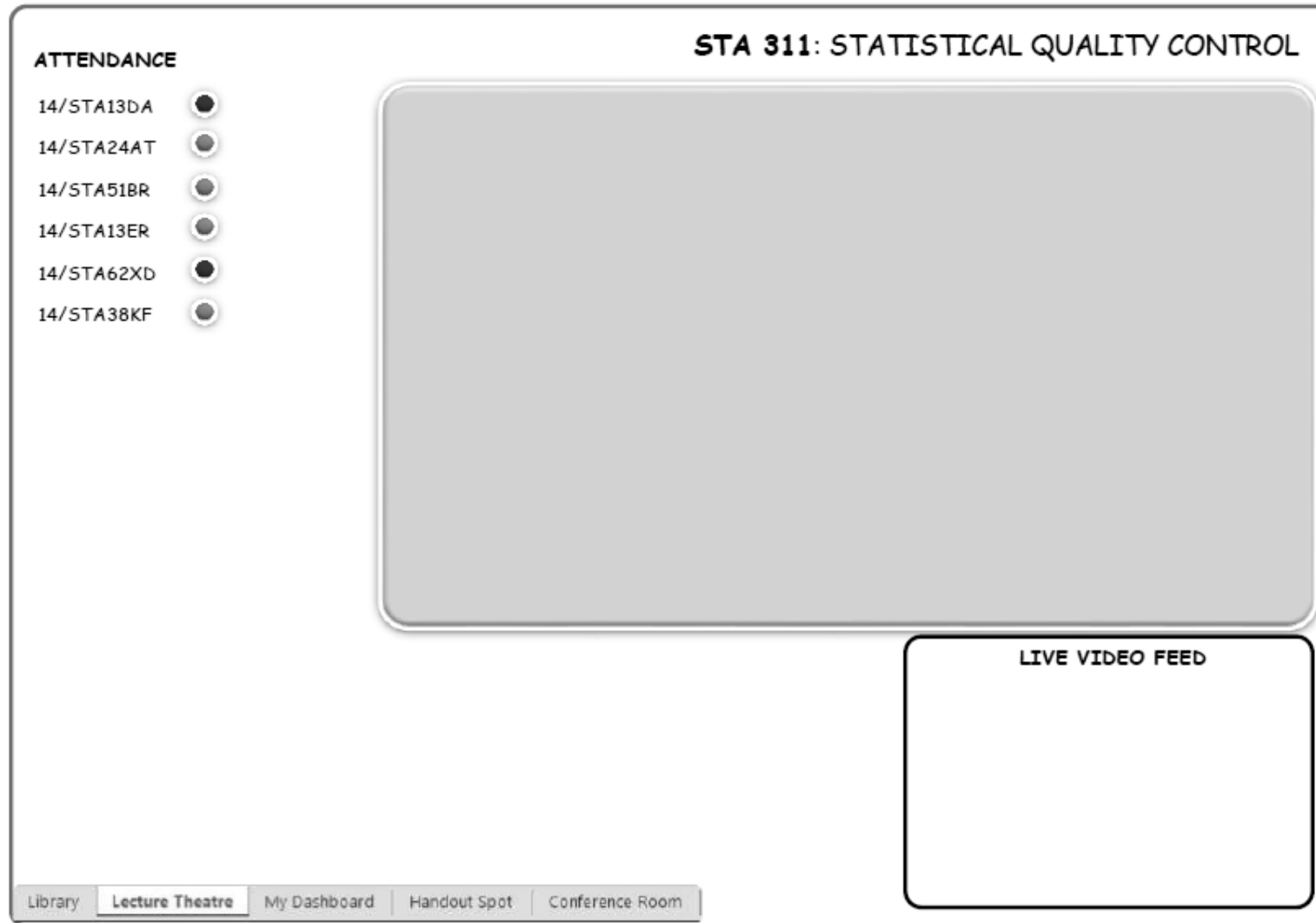


Figure 3: User Interactive Page

Features of C-BRIG *(Cont'd)*

- The vL is designed as an electronic replica of the traditional university library.
- Besides all the services accessible in the physical library, the vL comes with the extra benefits of 24-hour accessibility, real-time access to “Help” features, collaborative study platforms, and so on.
- Access is granted based on the university policy and regulation.

Features of C-BRIG (*Cont'd*)

- The vPW can be regarded as a personal account for faculty, staff and students where personal effects and correspondences can be domiciled.
- Through the vPW, personal effects such as test scores, results and scripts, fee payment status etc. can be viewed.

Features of C-BRIG *(Cont'd)*

- The vS is an electronic replica of the physical staff office.
- It allows lecturers within and outside various departments and colleges to engage in discussions at the convenience of their respective physical location within the university premises.
- It is most useful for “on-the-go” collaboration irrespective of space and time. It is worthy of note that accessibility is granted to academic staff only.

Features of C-BRIG (*Cont'd*)

- Using the vLT, lecturers and students can interface on an electronic platform in lieu of physical classroom lecture.
- Here, emergency or makeshift classes can be held at any time of the day.
 - Accessibility is granted to only lecturers or students of a given course of study.
- The vHS is primarily designed to be a hub where students can socialize at will.
 - Here, users can create custom groups to suite their preferences.
 - This feature is accessible to all students.

Significance of the Network Framework

- This will help in boosting the productivity of every member of the university community, and foster research collaborations and social interactions among several institutions that are physical separated but digitally connected.
- The expanded version of C-BRIG named i-Spider Information Grid (i-SPIG), will facilitate real-time information exchange among university campuses that are already on the C-BRIG platform.

Contributions

- One of the major contribution of C-BRIG to smart and connected campuses is the guaranteed network flow.
 - The system does not depend on the internet services provided by the telecommunication sectors and the Internet Service Providers (ISPs).
- Also, the system offers limited security risk since it is designed to guard against unauthorized intrusion or access.

Contributions

- Convenience, ease of use, and reliable access, are the prime advantages of the i-SPIG.
- Since the system runs on a Virtual Private Network (VPN) - via the internet – there exists the likelihood of exposure to malware threats, and dependence on Internet Service Providers (ISPs).
 - To curb this, each institution's C-BRIG is only accessible externally through a heavily secured and protected Gateway.

Conclusion

- The synergy between C-BRIG and i-SPIG platforms possesses a great potential to boost efficiency and productivity within and among smart and connected campuses.
- By this, institutions could expose their teeming students and lecturers to best international practices, thereby giving them a place to compete on a global scale.

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Thank You

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