Development of a Mobile Application: From University Website to Mobile App

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Abstract

In the era of technology, people are using smartphones for their everyday needs, like entertainment, communication, and education needs. Various organizations are developing mobile apps for their needs and using them for different purposes. Faculties, students, staff, and other stakeholders of Sylhet Agricultural University expressed surging demand for a mobile app for the university website. In the 21st Century, it was the need of the hour where everyone wanted mobile interactable sites. ICT individuals at the university undertook the mobile app development process and started with a decision that the mobile app should not replicate the full content of the university website. The research analyses the requirements and decide to decorate the app with the basic information such as various statutory bodies, faculty, department, different offices, news, and notice of the university that are necessary for the university stakeholders. Because of data integrity, pieces of information on the app are fetched from the university website automatically using API. As the information updates on the website, the data becomes visible to the app as well, subject to the internet connection. The key feature of this mobile app is that it can use previously saved materials when there is no access to the internet and eventually doesn't have a chance to access the latest content without internet.

Keywords: SAU App, Mobile Application, Website, SQLite, Android App

1. Introduction

Nowadays, Smartphones are almost pervasive in developed countries around the world. Currently, most of the world's population owns a smartphone, and the proportion is around 90%. According to Ericsson & The Radicati Group, there are 6.6 billion smartphone users worldwide which are increasing year by year and it is projected that the number of smartphone users will reach 7.3 billion by the year 2025. The number of smartphone users is up notably from the year 2016, only 3.6 billion smartphone users, which is 49.4% of the total population at that time. The rapid expansion of smartphones in society over the last seven years has drastically changed the scenario in which smartphones are used for business, education, gaming, entertainment, health, social activities, and marketing through mobile applications. Since the twenty centuries, smartphones have been considered a combination of a handheld computer and a mobile phone and became available worldwide and set the ground for the use and development of mobile applications[1]. Continuous enhancement in smartphones, for example, increased computational powers, enhanced battery capacity, increased various functionality, and widened screen size with higher resolution[2]. As smartphones have GPS, built-in photo or video editors, web browsers, wireless connectivity, voice recognition, and various other features offer a suitable environment to run different mobile apps that can provide context-specific content to users on smartphones like a PC[3]. Recently, because of the widespread use of smartphones at all levels of society, mobile applications have been developed and used by various sectors like banks, social media, music, marketing, and advertising to serve their purposes. Currently, the Google play store has 2.87 million and The Apple App Store has 1.96 million apps available for users to download[4]. Around 49% of smartphone users open an app 11+ times each day. Moreover, the average smartphone owner uses 10 apps per day and 30 apps per month[4]. Mobile apps are greatly contributing to the world's economic sector as it is estimated to have revenue of over 935 billion US dollars in the year 2023.

In the very beginning, mobile apps were developed for entertainment purposes only but nowadays almost all sectors, for example, business, education, health, gaming, entertainment, social activities, and marketing sectors are using mobile apps to serve various purposes to their customers. Especially, Banks and various mobile financial institutes are providing different financial activities such as e-payment, fund transfer, mobile top-up, etc.

through mobile apps. Additionally, a significant amount of industry and enterprise-specific apps were developed and used. To meet the increasing demands and the imposed challenges are addressed, tackled, and resolved by various researchers worldwide. There has been a significant number of research works carried out on software engineering for mobile apps to facilitate future app development. Researchers studied various characteristics related to app development, like app store mining analysis[5], various testing approaches for validation[6-8], user privacy enhancement and privacy behaviours[9], energy utilization and management[10, 11], software engineering and project estimation[12], project-based learning[13], and challenge-based learning[14] for app development. Various future research trends were analysed and discussed at different stages of the app development cycle[15] to help prospective app developers. The energy consumption rate is directly related to the satisfaction of app users. A novel approach to estimating energy consumption at the code level is proposed that enables developers to understand energy consumption behaviours[16].

In this paper, mobile app which was designed to meet the needs of university people is discussed. The organization of the rest of the paper is as follows. The justification of this work and the basics of mobile apps is described in sections II and III, respectively. The methodology is illustrated in section IV. In section V, the developed app is described following the conclusion and future work.

2. Basics of Mobile App

Sylhet Agricultural University is a higher academic institution which has a website for its branding and interacts with the target parties. A successful university website may improve user satisfaction, institutional legitimacy, and conversion rates. The SAU website offers its users the necessary details about the institution's goals and mission, its organisational structure, its academic services, its co-curricular activities, its facilities, its past and present research endeavours, its campus map, as well as its contact information and location on a Google map. This information about the university can be accessed via the internet using laptop, desktop computer, tab, smart phone etc.

Now Bangladesh has been experiencing a rapid rise in the number of smart phone and mobile internet users with the latest figure reaching above 9m and 60m respectively. University students are never without their smartphones. On average, a student spends over four to five hours a day on their smart mobile devices. With that in mind, universities have a

unique opportunity to take advantage of this growing trend of digital channels. An effective and interactive mobile application about university can improve a student's level of engagement on not only their course, but within their whole campus. University apps prompt students to interact with university and peers across digital channels.

With university Apps, users (Students, teachers, Staff, prospective students, Alumni, well-wishers, etc.) can access necessary information regarding mission and vision, administrative setup, academic information and features, curriculum, co-curricular activities, admission related info, previous and ongoing research works, facilities, and using this app, you can get a campus map of the university as well as other helpful features like contact information and location on a Google map. When users have direct access to what information they need, they are more likely to keep referring to the app on a regular basis. Therefore, the present research and development work is implemented to develop a mobile Application of SAU (SAU App) so that users can stay always connected beyond the campus.

3. Basics of Android Architecture

Based on the free and open-source Linux kernel, the Android operating system was created especially for touchscreen devices like smartphones and tablets. Google created the most popular version, which was first made public in 2007. More than 70% of smartphones built on the Android Open-Source Project run Google's ecosystem (often referred to as Android), some of which have vendor-specific user interfaces and software suites, as TouchWiz and later One UI by Samsung and HTC Sense.[17]. Since 2011 and since 2013, Android has been the most popular operating system (OS) for smartphones and tablets globally. Its installed base, which as of May 2021 had over three billion monthly active users, was the greatest of any operating system in the planet.[18]. The logo of android is shown in Figure 1.
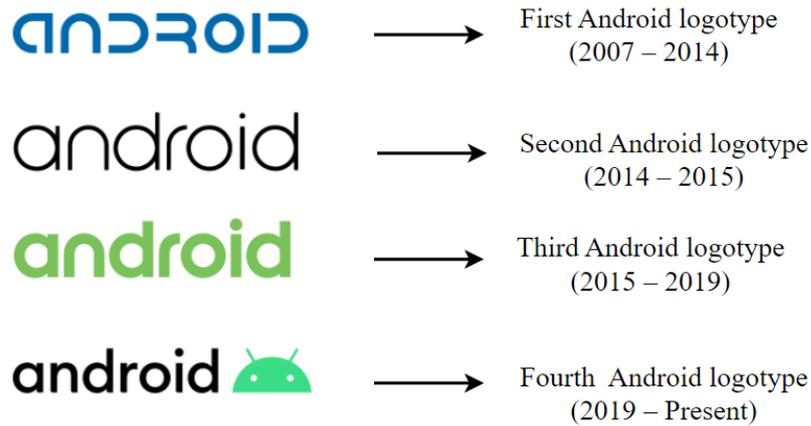
Figure 1. History of Android Logo.

Android architecture is known as android software stack that has five parts which is shown in figure 2. The five parts are as follows:

1. Linux kernel

2. Libraries

3. Android runtime

4. Application framework

5. Applications

Linux kernel is originally located at the bottom of the android architecture which is shown in Figure 2. It is called core or heart of android architecture responsible for managing drivers, resource access, power, memory, and device management. The driver includes camera driver, keyboard driver, Wi-Fi driver, audio driver, Bluetooth driver, USB driver etc. Android runtime and native libraries are using Linux kernel.

There are several native libraries built on top of the Linux kernel, including the free and open-source WebKit, OpenGL, FreeType, SQLite, Media, and C runtime library (libc). WebKit is an open-source browser engine that provides users with browser support. A useful repository for application data store and division, FreeType font support, and Media playback and recording of music and video formats are all provided by SQLite. Security is the responsibility of SSL libraries.

The third part of android architecture is android runtime that includes android runtime (ART) and core libraries. DVM (Dalvik Virtual Machine) is like JVM (Java Virtual Machine), but it is optimized for mobile devices and responsible to run android applications. DVM allows the developers to write codes using java language.

There is an Android framework in addition to Native libraries and the Android runtime. Through Android APIs, the Android framework offers a variety of high-level services, including telephony, resources, locations, window managers, activity managers, content providers (data), notification managers, and package managers. It offers a large number of classes and interfaces for creating Android applications.

An applications layer is present at the top of the Android framework. The Android framework, which makes use of the Android Runtime and Libraries, is used by all applications such as home, contact, settings, games, and browsers. The diagrammatic views of android architectures is shown in figure.2.
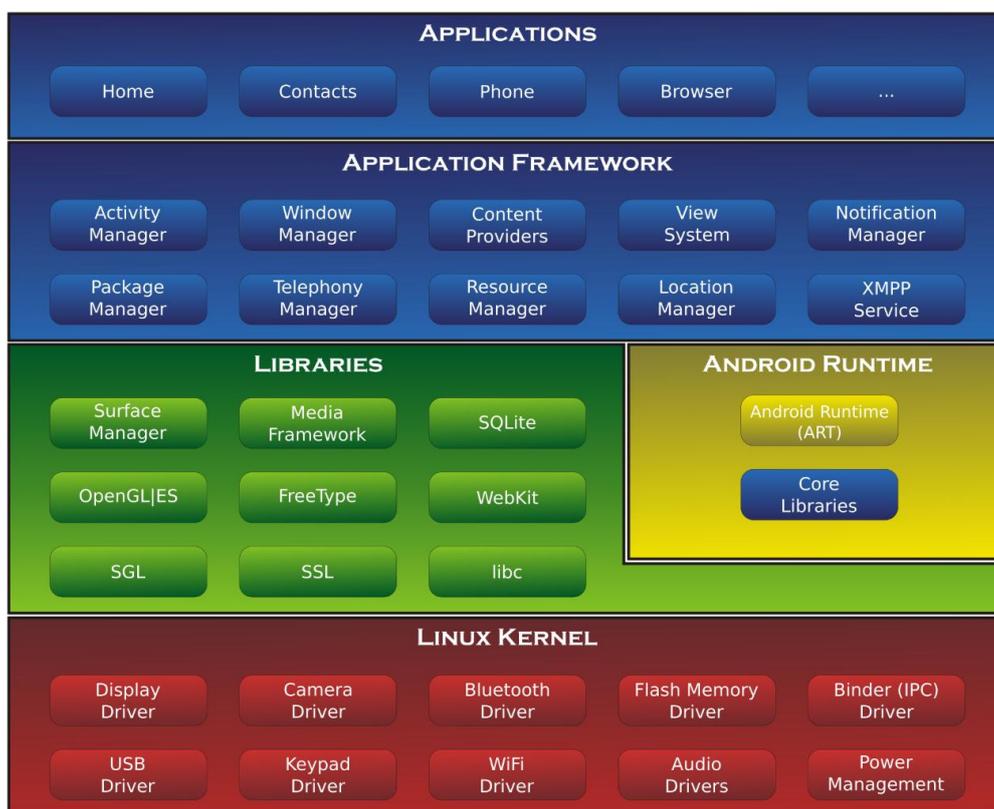

Figure 2. Diagrammatic Views of Android Architectures[19].

4. Development Methodology

According to the software engineering, the SAU app development process went through the following steps and attained the specific goals. The steps are as follows:

      i.   Prerequisite Analysis

      ii.   Project Design

      iii.   Stages in Development

      iv.   Testing

      v.   Deployment & Feedback

Requirement Analysis: Requirements analysis includes the tasks that determine the requirements for a new or changed product or project. The requirements for a project should be documented, actionable, measurable, testable, and traceable. Requirement analysis encompasses four types of activities: gathering requirement by interacting with users, analysing requirements to determining whether the collected requirements are vague, incomplete, ambiguous, or contradictory, and then resolving this problem if so. Requirement modelling for managing and documenting requirements. Finally, reviews the requirements. The Figure 3 shows the Steps involved in development of Application.
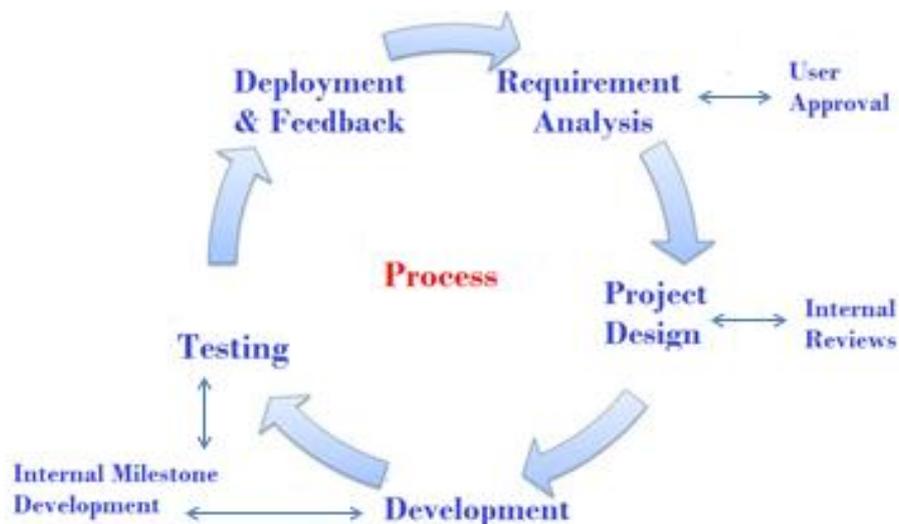

Figure 3. Steps Involved in Development of Application.

Project Design: Project design is an initial phase of the project where a project's key characteristics, structure, success criteria, and key deliverables are all planned. Project design step can generate various outcomes, such as skeleton, workflow charts, site trees, screen designs using HTML, product prototypes, photo, and many more.

Development: Software development is the process of computer programming, documenting, coding, testing, and bug fixing and solving involved in building and maintaining applications and frameworks. Software development is a process of writing and maintaining the source code. In the development of mobile application for Sylhet Agricultural University (SAU App), the following tools are utilized.

- JAVA

- Android Studio

- PHP

- MySQL

- SQLite

To avoid the data redundancy, Developing of a user-side software is made easier via API. A client and a server's interface or communication protocol is known as an application programming interface (API). The Figure 4 shows the Graphical illustration of how SAU App read and displayed data from website.
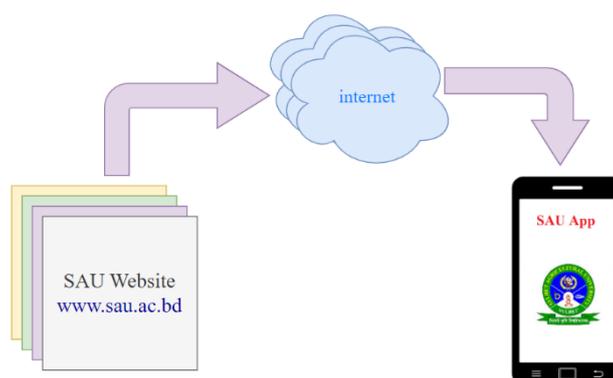
Figure 4. Graphical Illustration of how SAU App Read and Displayed Data from Website.

According to one description, there is a "contract" between the client and the server that states that if the client submits a request in a certain format, the server will always respond in the same manner or to take necessary action[20]. APIs are designed to developed SAU App. The table.1 below shows the APIs functionality description with website data.

Table 1. APIS Functionality Description with Website Data.

S/N	Menu Name	Source Application	API Response Type	Description
1	Basic Setting		JSON	This API is responsible for providing basic setting of APS
1	At a Glance		JSON	API provides at a glance information of SAU
2	Authority		JSON	
3	Notice		JSON	Last 10 active notice
4	Faculty		JSON	Provides all faculty name and corresponding departments list. This API also responsible to provide employee list of faculty office including dean as well as details of faculty.
5	Department	SAU Website	JSON	This API is responsible to provide details of the department as well as all faculty member list including faculty members basic contact information.
5	Administration		JSON	This API is responsible to provide details of the respective office/department as well as all officers lists including their basic contact information.
6	Proctor		JSON	Peoples and rules.
7	Holidays		JSON	List of holidays
8	Hall		JSON	This API is responsible to provide hall list including details of respective hall.
9	Health Care Centre		JSON	Description and Doctors list with contact number.

| 10	Veterinary Hospital		JSON	Description and Doctors list.
11	Transport		JSON	Schedule and officials list.

Testing: Software testing is a process of executing a written code or application with the aim of finding and solving the software errors or bugs. It can also be called as the process of validating and verifying that an application or product is working properly.

Deployment & Feedback: In the software deployment phase, the developed app is deployed in google play store and maintained.

5. Detailed about Developed App

The mobile application of Sylhet Agricultural university (SAU App) is designed and developed with all important features of the university such as mission and vision of SAU, administrative setup, academic information and features, curriculum, faculty members with contact and research interest, Offices with officer lists, co-curricular activities, admission related information, facilities, past and current research works, a campus plan, and other helpful details, such as contact information and position on a Google map, are all included. Various pages of the app are shown as follows:

Mobile User Interface (UI): Splash screen load at very first time and shown in the mobile screen. The figures below show the screen shots of the different pages of the mobile application.
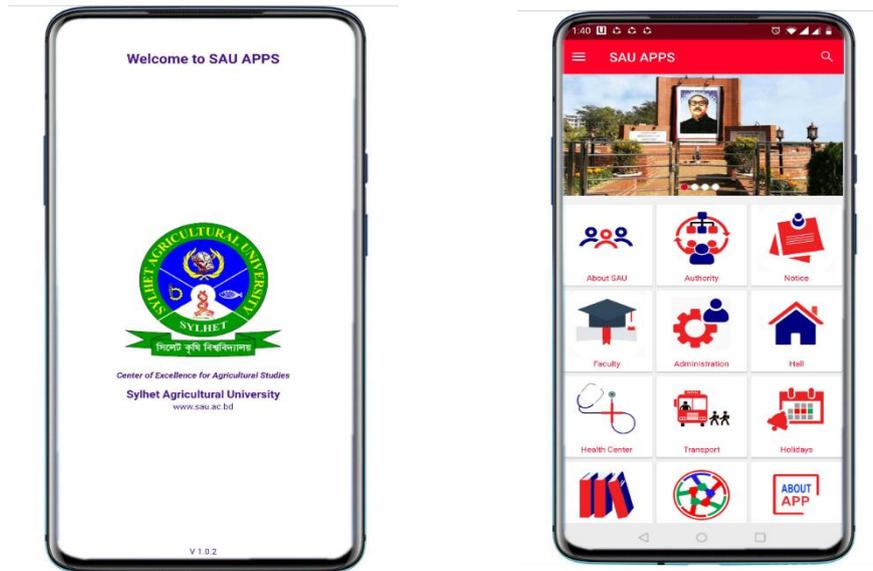
**Figure 5.** Splash Screen and Interface of the Mobile Application.

The home page and the navigation menu of the developed application is shown in fig.5

About SAU: This section includes all important information regarding Sylhet Agricultural University briefly.
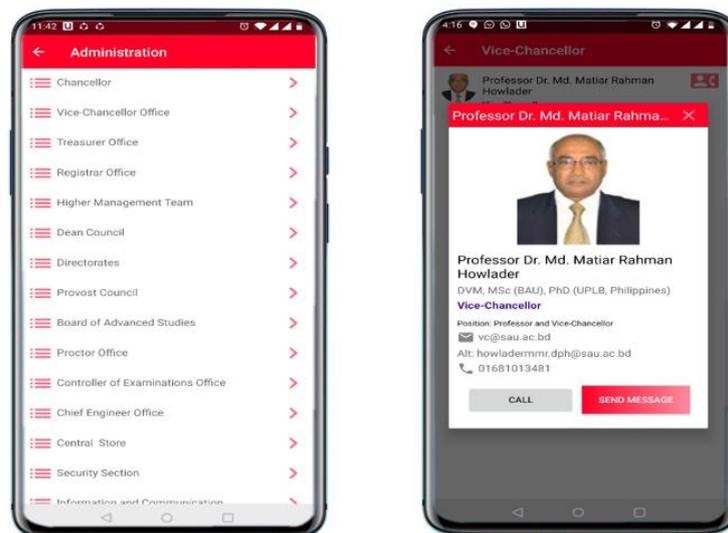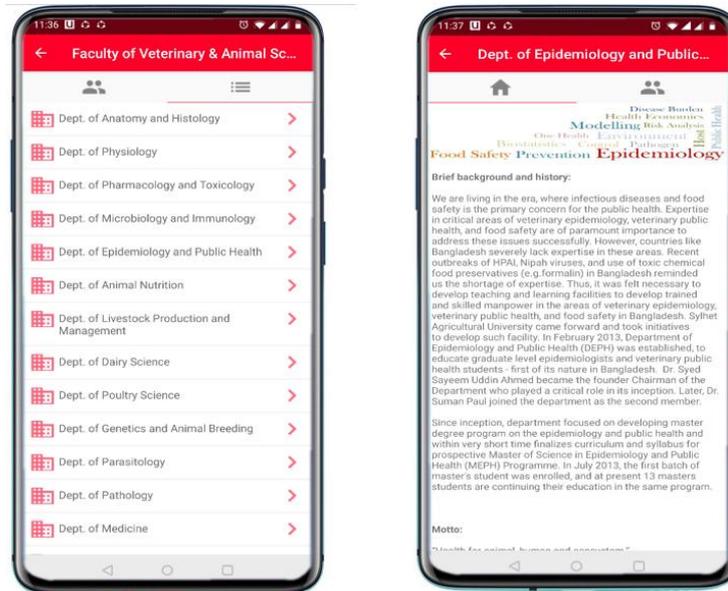

Figure 6. Administration and Vice-Chancellor screen.

The figure .6 shows the departments that handle the administration of the college and the page that enables one to call or send message to the vicechancellor
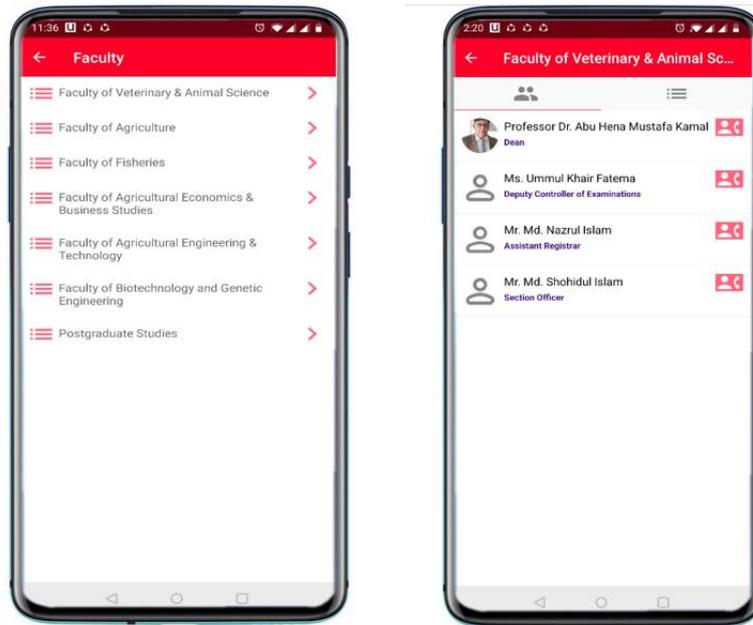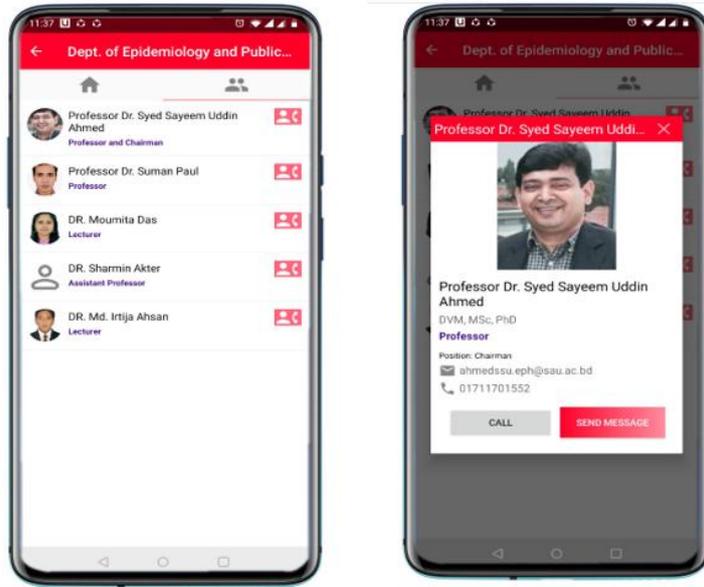
Figure 7. Faculty and Dean Office.

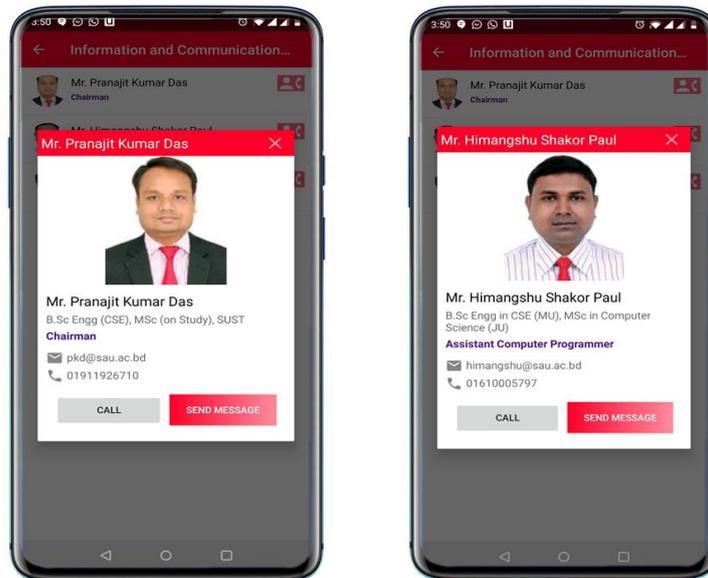The details of the faculty and the dean office are depicted in figure .7

Figure 8. Faculty and Departmental Front Page.

The Details of the faculty and the departmental front page are shown in figure .8

Figure 9. Departmental Faculty List and Contact.

The Figure 9 shows the details of the departmental faculty list and contact.

Figure 10. ICT Official Contact Details.

The ICT official contact details are shown in figure .10 and the figure .11 depicts the Official notice and academic resource details.
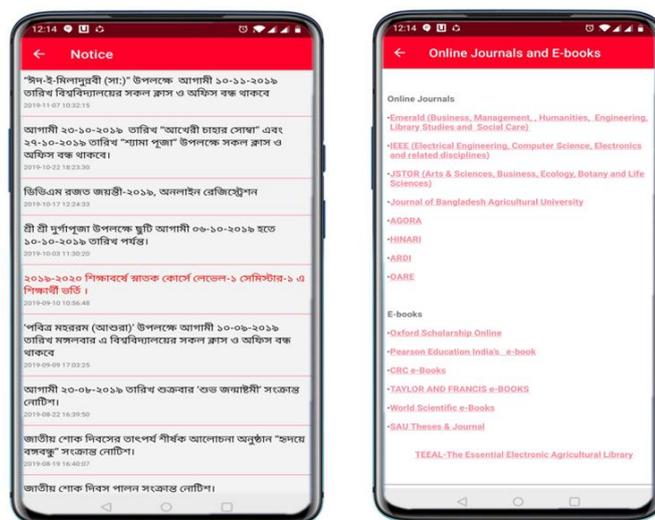
Figure 11. Official Notice and Academic Resource Details.

Figure 12. QR Code for SAU App.

The QR code that enables the user to easily access the website is shown in the figure .12

6. Conclusion and Future Work

A successful mobile application for a university website can boost conversions, improve user satisfaction, and build institutional reputation and brand. It is a new way for a university to interact with student, faculty, supporting staffs, and other relevant stakeholders. This mobile application can improve a student's level engagement on not only their academic purposes but relate various others part of whole campus. Through this University app (SAU

App), students and others can interact with university and peers across digital channels promptly. When the stakeholders have direct access to what information they need, they are more likely to keep referring to the app on a regular basis. This app will be maintained timely basis so that it can serve it purposes properly.

Acknowledgements

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