AN EDUCATIONAL BLUETOOTH QUIZZING APPLICATION IN ANDROID

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ABSTRACT

Bluetooth is one of the most prevalent technologies available on mobile phones. One of the key questions how to harness this technology in an educational manner in universities and schools. This paper is about a Bluetooth quizzing system which will be used to administer quizzes to students of a university. The Bluetooth quizzing application consists of a server and client mobile Android application. It will utilize a queuing system to allow many clients to connect simultaneously to the server. When clients connect, they can register or choose the option to complete a quiz that the lecturer selected. Results are automatically sent when quiz is done from the client application. Data analysis can then be done to review the progress of students.

KEYWORDS

Bluetooth, Wireless networks, Educational applications, Quizzing applications

1. INTRODUCTION

The use of Bluetooth is eminent in today's society. It is usually a default technology that is present on all mobile phones as stated by (Korucu and Alkan 2011, 1929). The ratio of mobile phones to fixed phones in Trinidad and Tobago is 6.3:1 as stated by the (International Telecommunications Union 2011). Hence, it is safe to assume that Bluetooth is one of the most prominent wireless technologies in Trinidad and Tobago.

Its uses range from transferring files to opening garage doors. (Hosny 2007, 972) stated that it is a low power, inexpensive, short-range wireless standard supporting local area networks (LANs). It is a useful tool for executing small tasks that are not data intensive.

One of the key questions is how to harness the use of this technology in the education system. The purpose of this project is to explore the use of Bluetooth as a line of communication for the delivery of educational materials. The problems that this could address at any educational institute are: 1) low attendance rate 2) low pass rates 3) poor learning curve of students.

A paper based quiz system in every class can be too time-consuming. Therefore, a Bluetooth quizzing system was thought to be the most cost effective, quick method of addressing the above problems. The system collects responses, calculate marks and send quiz scores back to students. In this way, students are encouraged to learn their work continuously before every class.

(Bar, Haussge, Robling 2007, 281) stated that when taking a 2(two) minute break after 20(twenty) minutes of lecture, the learning result of students is increased. The media break, as the study

DOI : 10.5121/ijwmn.2013.5605

outlines, is in the form of questions directed to the students. Asking these questions, presents the students with an opportunity to reflect the learnt material. Using this concept, the report aims to utilize the Bluetooth quizzing system as the break format during lectures to stimulate the students about thinking about the course more in depth and to encourage them to ask questions. The questions in the Bluetooth quizzing system are in the form of multiple choices.

Also, (Ruhl and Suritsky 1995, 2) and (Ruhl et al. 2012, 62) indicated that the pause procedure alone was most effective for enhancing student performance on immediate free-recall of lecture ideas. Even though this study was done using students with disabilities, the same concept can be applied to any other student, with the use of quizzes during lectures.

The system consists of a server component and a client component. The server component is controlled by the lecturer whereas the client component is in the hands of the students. Both components are in the form of an Android application. At the server, the lecturer allows students to register (send their initial data to the server), add/edit courses, students and quizzes. Registration consists of data such as first name, last name student identification number among other bio-data. The lecturer can also create quizzes consisting of multiple choice questions. After creating these quizzes, the lecturer can dispense the quiz to students via the quizzing phase (This is explained in greater detail later). The quizzing phase also consists of sending back results to students. In addition, the lecturer can then perform data analysis on the data received. Statistics is represented with the use of pie charts. This will allow the lecturer to keep track of the students' performances. This Bluetooth quizzing system will be referred to as BLUEQ.

2. LITERATURE REVIEW

There have been other attempts to implement a classroom Bluetooth quizzing system to encourage interaction between the lecturer and students.

(Davidrajulh 2009) presented a Bluetooth-based classroom tool. It is a paper focused on evaluating a Bluetooth-based classroom tool. This tool was used to help lecturers automate their assignment tests. The paper however, was limited to 2 (two) handhelds and a master device. In this system, students used their mobile phones to submit answers to assignment tests to the lecturer's computer via Bluetooth. By doing this, the lecturer does not need to correct assignment tests. In addition, the system was also used to disperse multiple choice questions to the students during the lectures. The students would then submit their answers to the lecturer's machine. In both scenarios however, no test scores were sent back to the student.

Another system was also developed by (El Sharkawy and Meawad 2009) which was a mobile quizzing system through which students can answer short questions in lectures with the use of SMS (short messaging service) or Bluetooth. The main objective of this system was to provide the students with different technology options that would enhance their learning experience, as well as, encourage them to attend lectures thereby increasing the level of participation. The server component of this system consisted of a web module, a GSM modem, and SMS gateway and a Bluetooth module.

The client consisted of Java ME mobile application. The evaluation of this system showed that students were enthusiastic about using the system. The system also consisted of a statistical section that allowed the lecturer to view the statistics after a quizzing session. In this section, all the submitted answers are gathered, and charts displaying the different answers were shown.
Another complex system was developed by (Bar et al. 2006, 361) which encompassed SMS (short messaging service), WLAN (wireless local area network) and Bluetooth as part of the system to

engage the students in their classrooms (Figure 1 shows the arrangement).It allowed students to use their mobile devices, using Bluetooth to interact with the educator during lectures. That is, it allowed students to answer questions presented by the educator. The answers to the questions were presented at the end of the lecture. Their Bluetooth model was designed for Linux using Blueproxy (Blueproxy is a simple proxy server to convert Bluetooth RFCOMM connections into TCP connections). While this was a fantastic idea for implementing the system, this option is costly (SMS is costly) whereas Bluetooth is free and pervasive. Hence, Bluetooth will be a better suited option for the delivery of content to students via the Bluetooth quizzing system. However, SMS is facilitated once in close proximity to a cell tower, whereas Bluetooth has a range of 10 meters for class 3 devices.

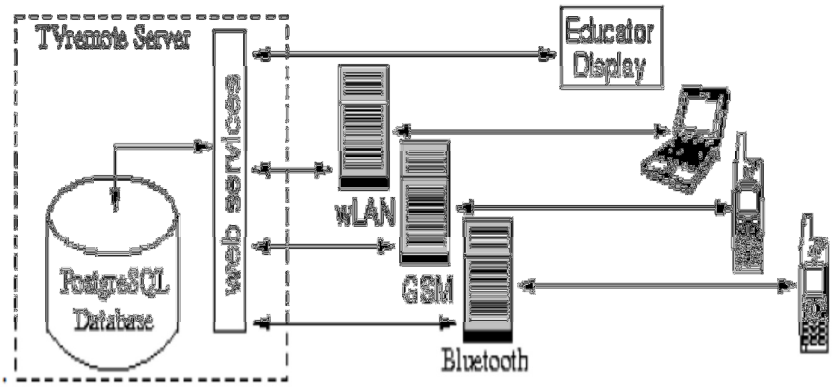
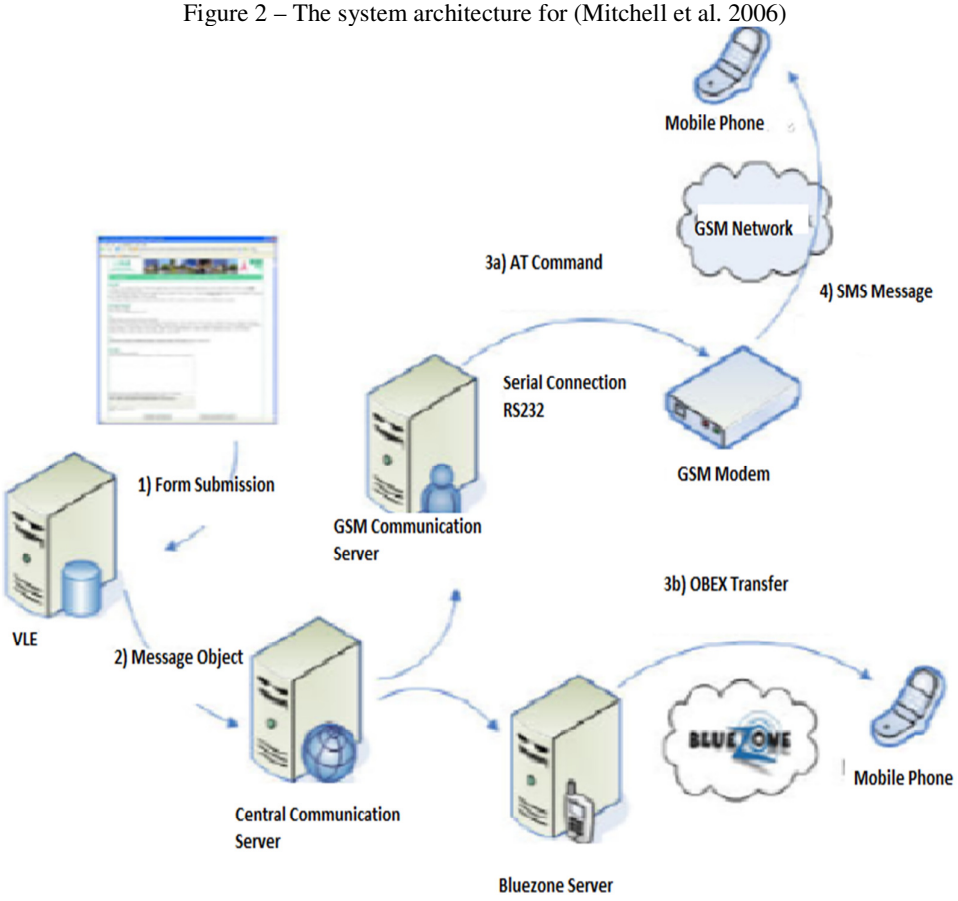


Figure 1 – The system architecture (Bar et al. 2006).

Yet another (Zhang, Li, and Fu 2007) Bluetooth based e-learning system, was used to break the constraints of time and space (The teacher received instant feedback from students and check students' performance at any time. Later (Zhang, Xiong, and Luo 2011) applied the same principle to a mobile English assistant learning system based on Bluetooth. That is, the system was later built around an English lecture session.

(Mitchell et al. 2006) investigated the use of mobile and smart phones as a platform for delivering mobile learning services and administrative information on a personalized basis. The system utilized two technologies SMS (short messaging service) and Bluetooth. The two technologies were used to complement each other to offer an alternative communications platform for students. This combination provided a mechanism for communication with undergraduates on a large scale. Figure 2 shows the architecture, with the flow beginning the mobile phone.

Figure 2 – The system architecture for (Mitchell et al. 2006)



Finally, (Wang, Zhu, and Zhao 2010) developed a wireless communication educational lab based on Bluetooth. The goal of this system was to encourage students to learn by themselves. This lab focused on practical assignments which would help the students develop skills not found in a textbook. The aim was to help students grasp wireless communication from theory to practice.

As it can be seen, there have been many attempts at creating a Bluetooth quizzing application for interaction between lecturer and student. However, these implementations are a bit outdated and none of have been designed for the Android platform, which is the leading operating system today. According to International Data Corporation (2013), the Android operating system (OS) had 68.8 % market share, which makes it the best OS to create applications that will reach a wider audience (in this case students). This report seeks to fill this gap while solving the issues outlined in the Introduction.

3. APPLICATION DETAILS

There are 2 components to the Bluetooth quizzing system: Server Side and Client Side. Both components are implemented on the Android operating system (on a phone). Android was chosen as it is very popular mobile platform today. Options presented at the server are: Start Server, Manager, Data Analysis and Exit. Figure 3 shows the main menu for the server. 'Exit' is used to exit the application. 'Start Server' turns the server on/off, monitors incoming connections as well as provides a list of quizzes to allow the lecturer to select a quiz to send to students. 'Manager' consists of creating and editing new courses, quizzes and students. 'Data Analysis' is for performing basic statistical analysis on results obtained from quizzes.

Figure 3 – The main menu for the server application of BLUEQ.

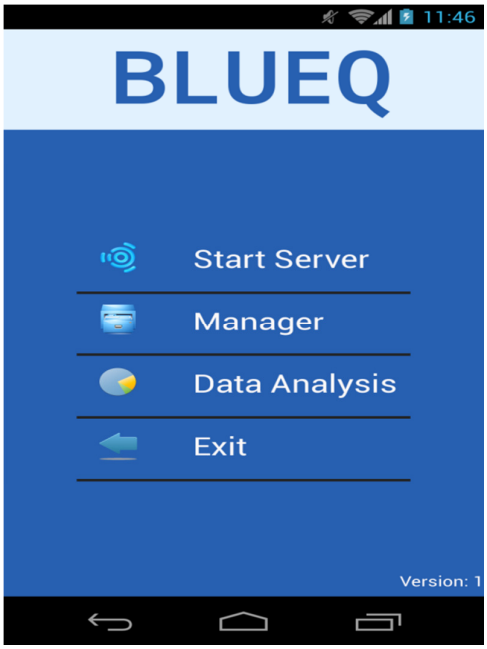


Figure 4 – Client/Server sequence diagram.

In Figure 4, the server is started when the user presses the Start Server toggle button on the server application. Figure 5 shows the"Start Server" screen of the BLUEQ application.

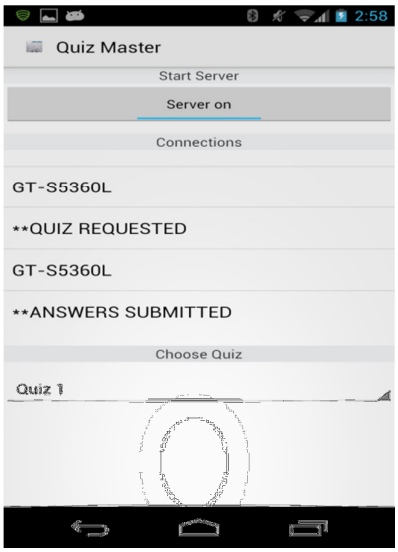


Figure 5 – Start Server screen of the BLUEQ application.

The method start Server() turns on Bluetooth at the same time. In order for client devices to find the server, it must be made discoverable by calling ensure Discoverable(). Once the server can be seen, then the quizzing service is started by calling setup Service(). At this point, the server is started and sequentially selects a UUID from a queue of UUID's. A Bluetooth Server Socketis created listening on the RFCOMM channel associated with this UUID. When a client opens a connection using the same UUID, a Bluetooth Socket is spawned for that client. The server then listens on another RFCOMM channel for another client.

A blocking queue was used to store the UUIDS that are going to be used to get the RFCOMM channels. There are 8 UUIDS that will be selected. Since the accept() method is a system blocking call, it states that the device will not be able to perform anything else, hence only one server can be used. But the UUID's will be cycled to choose the correct RFCOMM.

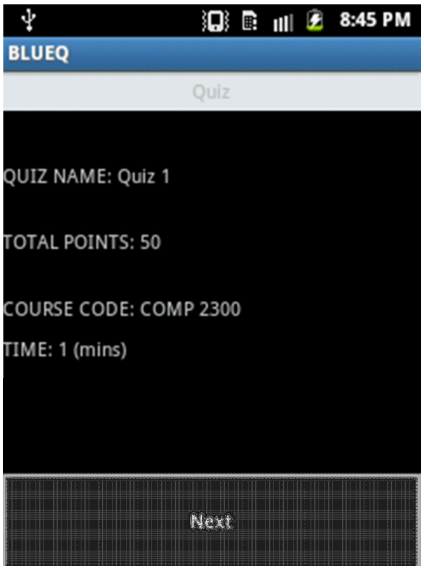
According to the RFCOMM white paper, protocol theoretically supports up to 60 simultaneous connections between two Bluetooth devices. The number of connections that can be used simultaneously in a Bluetooth device is implementation-specific. In experiment at with the android devices, this value was found to be roughly 5. More memory could contribute to more connections simultaneously. Hence, we estimated around 8 UUID's, that's why 8 UUIDswere chosen.

For the client application to work, the Bluetooth must be turned on. The client has to then search for the server by doing a device discovery. Scan For Devices () searches for all devices in close proximity to the client. A list of devices found is presented to the user. User interaction is required to select the server.

Once the server is selected, a service discovery is executed. This is where the client uses the same UUID as the server. The server then does a look in the service discovery database to ensure service is listed. Once the match is successful, the server sends the RFCOMM channel number on which the service is listening.

The client then connects to the server using the RFCOMM channel number. Data transfer to the server then begins.Data transfer in this case, will be the requests sent by the client. For example, as in Figure 6 showing the client requested a quiz, which is shown.

Figure 6– Quiz details presented to the student.



4. MODELING

This section presents a probability model of how successful clients will be in connecting to the server. We have 8 UUIDS, assuming there n = 25 (25 clients trying to connect).

We have managed to model the above scheme using the geometric distribution.

X is the discrete random variable, which is the number of attempts needed to connect to an RFCOMM channel successfully.

X~Geo(p) where p = 8/25 = 0.32(assuming 8 UUIDs always in the queue in the client, since only 1 can connect at a time)and q = 17/25=0.68

Probability that the first success is obtained at the rth attempt P(X=r) = qr-1 x p

So finding the probability that the client connects on its 2th attempt, P(X=2) = (17/25)1(8/25) = 0.22

And finding the probability that the client connects on its 6th attempt, P(X=6) = (17/25)5 (8/25) = 0.05

Hence, the probability that the client takes a large number of attempts to connect decreases as the number of attempts increases. This means the probability of connecting on the first few attempts is large.

5. CONCLUSION

A Bluetooth quizzing application was developed for use in lectures, to help lecturers administer quizzes and in turn help students revise work previously learnt. Students will benefit by revising work done in previous classes.

The queuing method of UUID's proved to be very useful due to the constraints of the Bluetooth technology. The probability of taken too many attempts was found to be very small.

Future works could improve on this method for supporting more simultaneously Bluetooth connections on the server side. Also, the means of communicated can be improved by using XML to structure messages passed between client and server.

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