

Classroom Response System

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Abstract

Wireless technologies are becoming extremely popular around the world. Mobile phones have become highly available. The response system is still to find its use in the schools and colleges across India. Once it is implemented, it can revolutionize the teaching methodology. Classroom response systems can benefit the faculty in all three areas of responsibility: Teaching, Service and Research. The various goalsof classroom response systems are to improve student learning, to improve teaching effectiveness, to greatly reduce the paperwork and faculty labour associated with: 1) attendance taking, 2) test administration and 3) grade recording, calculation and analysis.

Keywords: MATLAB, Wireless, Bluetooth, Response

1. Introduction

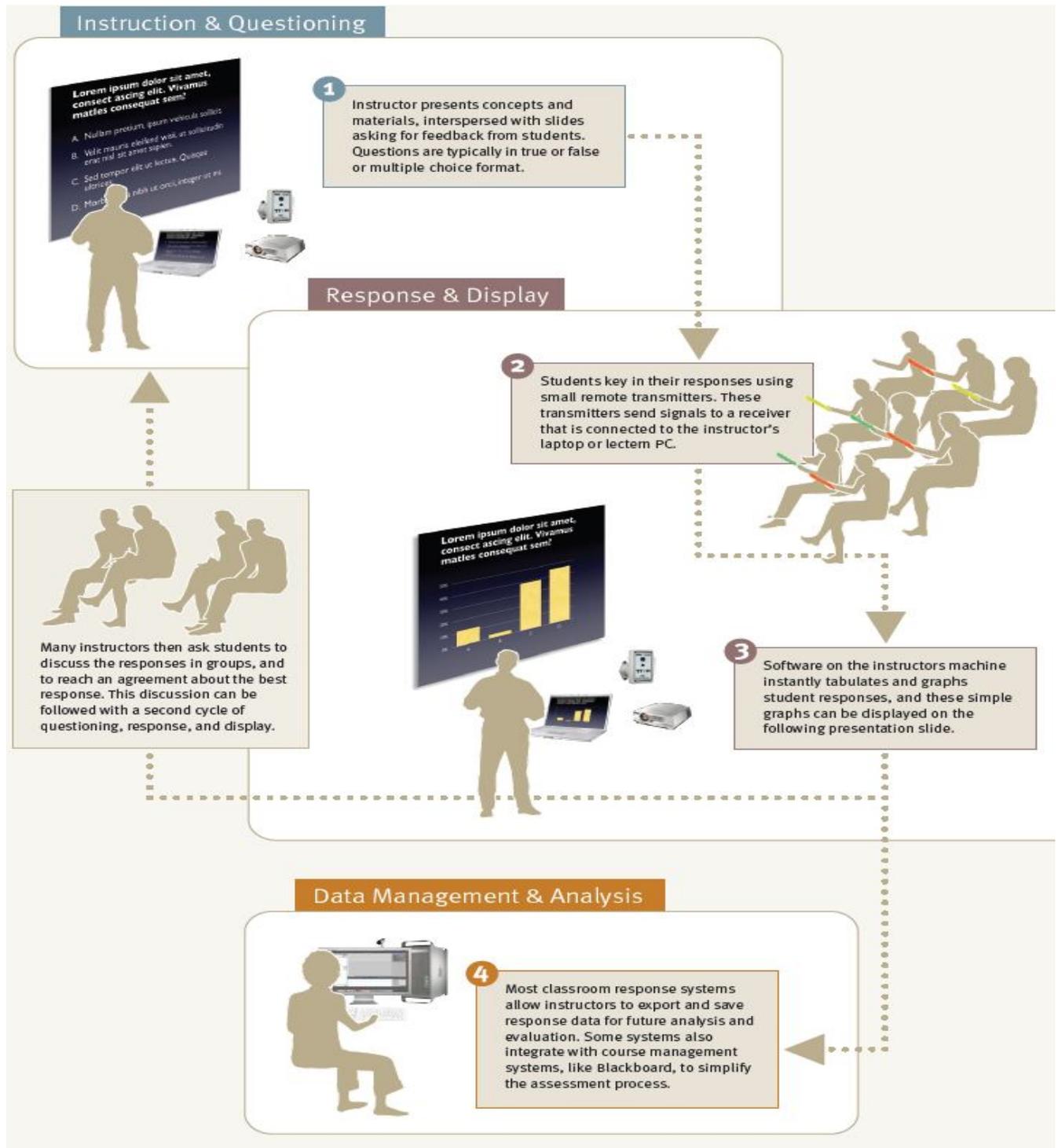
CLASSROOM RESPONSE SYSTEM (CRS) is an evolving in-class-student-pollingtechnology designed to create an interactive learning environment especially in large-enrolment lectures. The project' CLASSROOM RESPONSE SYSTEM (CRS) is based on wireless technology which is implemented using 'Bluetooth'. Project involves the interface of the PC with the handheld devices (Bluetooth enabled mobile phones) held by the end users.

The operation of classroom response systems is a simple three-step route:

- 1) During class discussion or lecture, the instructor displays or voices a question or problem– previously prepared or spontaneously generated “on the fly” by the instructor.
- 2) Students punch their answers using wireless handheld keypads.
- 3) Responses are received, aggregated, and displayed on the instructor’s screen. The spread of student responses may prompt the students or instructor to consider further or perhaps one or more follow-up questions. This shared cycle can continue until both the instructor and the students have resolved ambiguities or reached closure on the topic at hand.

2. Concept

In Classroom Response System, the Professor presents a question, which are typically of ‘True or False’ or ‘Multiple Choice’ format. By launching the application installed on the mobile phone of every student, responses can be sent to the Professor’s PC. These responses would be sent via BLUETOOTH to the centralized unit (the laptop). On receiving the responses on the Professor’s PC, a MATLAB program runs which compares them with a database of correct responses, tabulates the results, produces graphs and then displays these graphs during the lecture. Based on these results, Professors engage students for discussion, highlighting the important points or clarifying the ambiguities for which wrong responses were given.



3. Working Principle

The working of the project is based on Bluetooth technology. It involves the interfacing of the Hand-Held devices (BT-Enabled Mobile Phones) with the Laptop. Initially the students start the J2ME-based application installed on their Mobile phones. Using this application they key-in their responses for the questions put up on the projector screen. The cell phones then establish a Bluetooth connection (i.e. they migrate from the 'Parked Mode' into the 'Active Mode') with the Central Unit. Once the responses are transmitted the particular cell phone is switched back to the 'Parked Mode', this is taken care of by MATLAB (R2011b). This process continues, thereby allowing more than 7 students to key-in their responses.

A MATLAB program analyses the responses and compares them with a database of correct answers and displays the results in the form of Bar-Graphs and Pie-Charts. The Professor uses the charts and graphs to evaluate the performance of the students.

4. Implementation

4.1. J2ME

To write J2ME source code we require two softwares which are: Java Software Developers Kit (SDK) 1.4.1. and J2ME Wireless Toolkit Version 2.2. The programs are written in Notepad and then are compiled using wireless toolkit as shown below

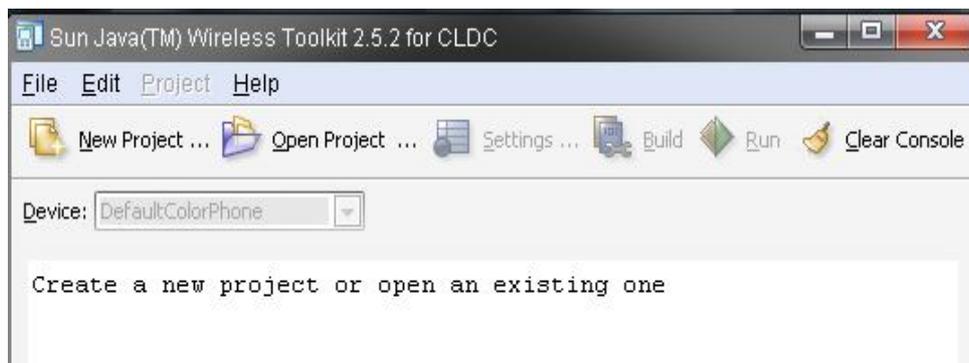


Figure 1: Screen Shot of the Wireless Toolkit.

The actual application on the Mobile Phone would look as follows:

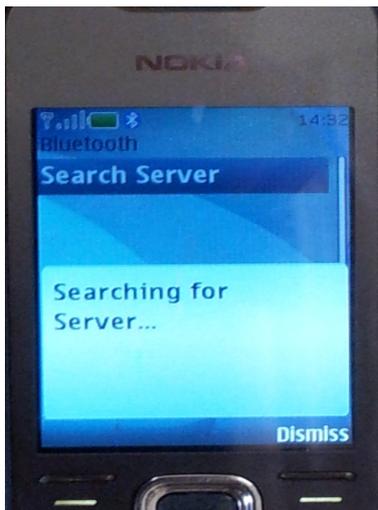


Figure 2: Server Screen



Figure 3: Device List Screen



Figure 4: Response Screen

4.2. MATLAB

One can read and write both text data (ASCII based) and binary data from end user, in MATLAB. For text data, use the `fscanf` and `fprintf` functions. For binary data, use the `fread` and `fwrite` functions.

The Bluetooth connection is established by MATLAB between user and central unit. Following steps are performed to communicate with the Bluetooth devices:

1. Determine what Bluetooth devices are accessible from your computer.
`b=instrhwinfo('Bluetooth')`
2. View the device list using the `RemoteNames` property.
`b.RemoteNames`
3. In this case, `-3db` is the remote name of the Cell Phone and is shown in the output. Display the information about this device using the `Bluetooth` interface and the `RemoteName` property.
`nstrhwinfo('Bluetooth','-3db')`

4. The Instrument Control Toolbox displays the device information.

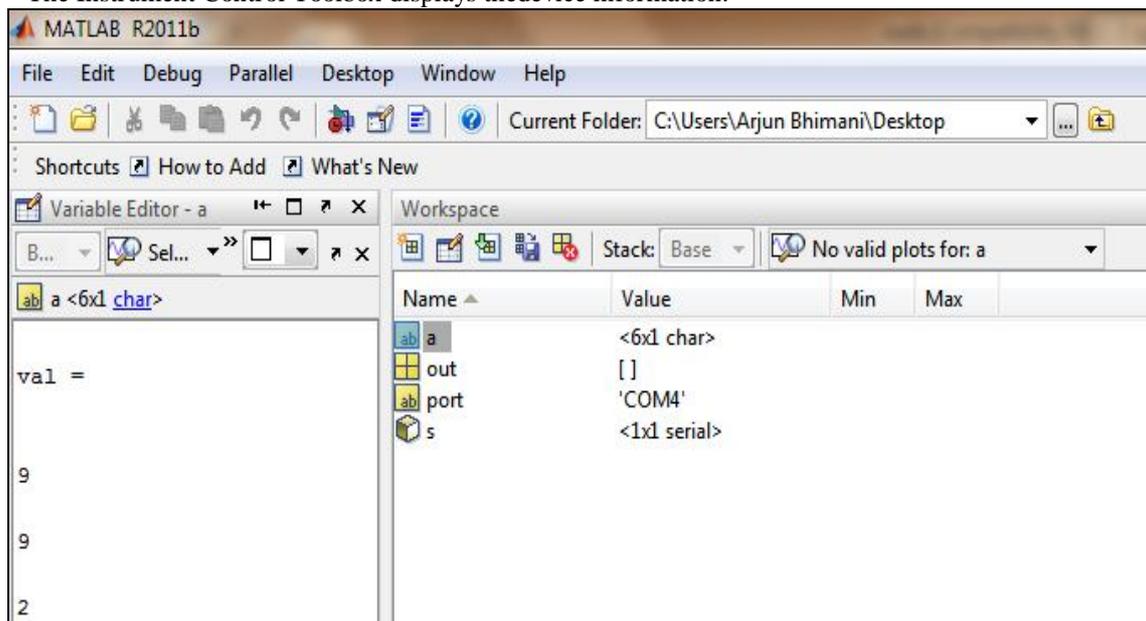


Figure 5: The Command Window displaying the Bluetooth device '-3db' along with its ID and other information.

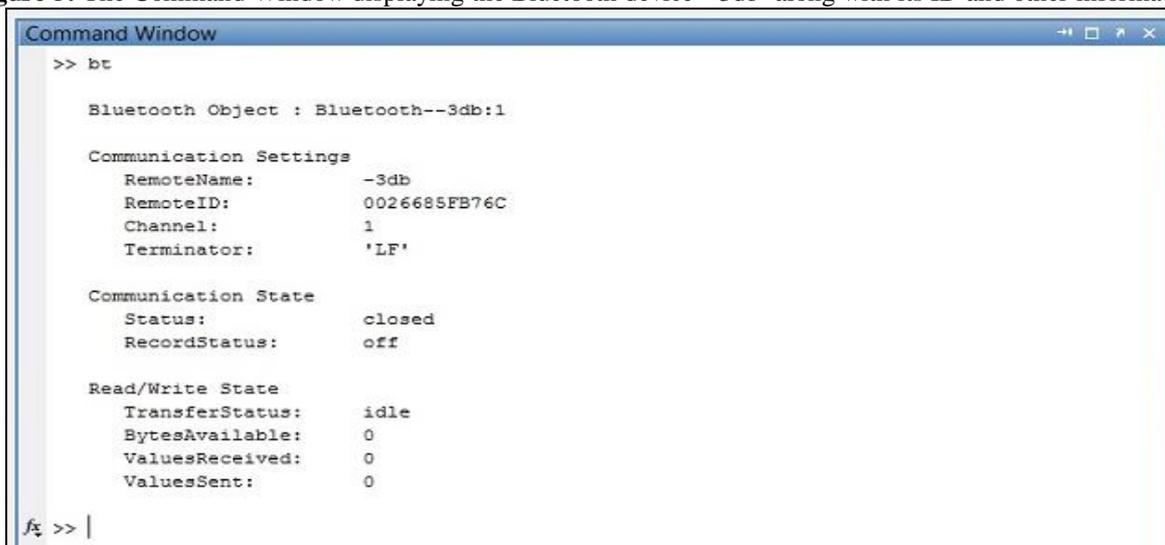


Figure 6: Matlab Output Screen showing the ID of the student i.e. 99 and the response given by him ('2' which stands for option 'C' in the Mobile Application).

5. Create a Bluetooth object called 'bt' using channel 1 of the Bluetooth device.

```
bt = Bluetooth('-3db', 1);
```

6. Connect to the device.

```
fopen(bt)
```

7. Send a message to the remote device using the `fwrite` function. In this example, specific characters are sent to the device that this particular device (the Bluetooth Cell Phone '-3db') understands. You can write to the device, and then query the object, as shown here, to see that the values were sent.

8. Read data from the remote device using the `fread` function. The `ValuesSent` is 4, which are the four characters sent in `fwrite(2,0,1,155)`. This also shows that 35 bytes are available. So you can then use the `fread` function and give it 35 bytes to read the characters from the remote device. The device returns the characters shown here. The returned characters are -3db, which is the `RemoteName` of the device. That was a reply to the instructions that were sent to it. See the documentation for your device for type of device-specific communication information.

9. Clean up by deleting and clearing the object.

```
10. fclose(bt);  
clear(bt);
```

The responses would then be processed by a MATLAB code to give detailed analysis as follows:

Compare the data with a previously stored Database.

Declare the result (number of correct responses, total number of responses, etc.)

Display the result in the form of Bar Graphs and Pie Charts.

For e.g.: Suppose the teacher presents a question to which 80% of the students give the correct answer and the rest give incorrect. This data would be presented by MATLAB as follows:

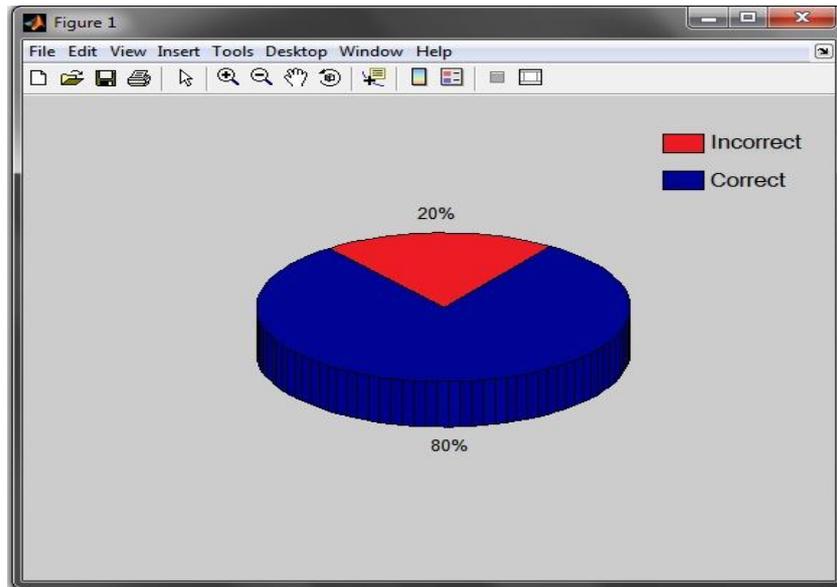


Figure 7: Pie Chart depicting the result of responses, given by the students, as seen in MATLAB.

Also a Weekly or Monthly analysis of all the lectures and the number of Correct v/s Incorrect Responses is possible which gives the faculty a brief idea as to how has the series of lectures progressed so far, using (Bar Graphs) in MATLAB.

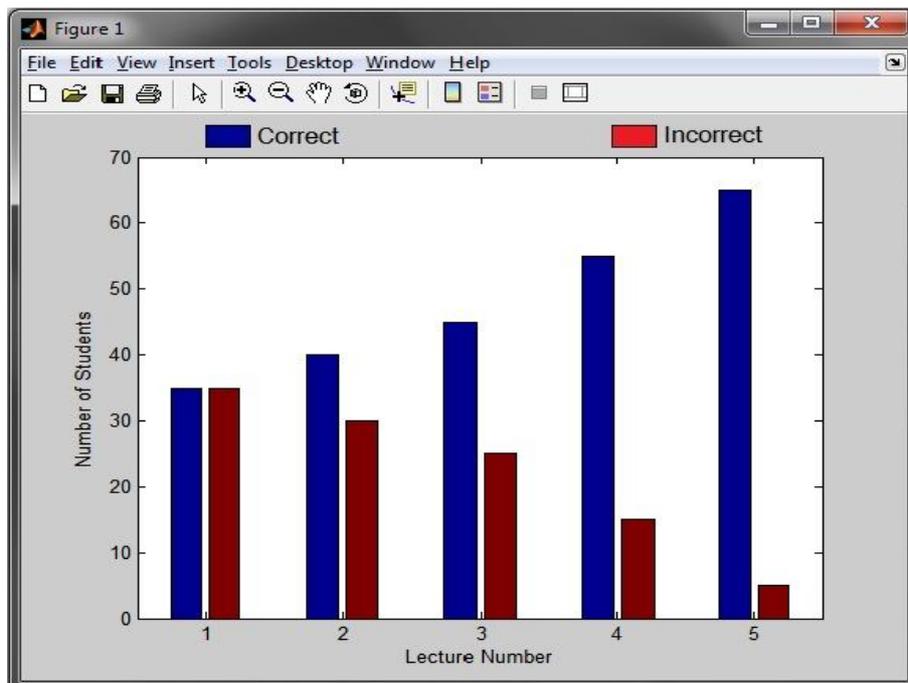


Figure 8: Bar Graph comparing the number of 'Correct' to the number of 'Incorrect' responses over a series of 5 lectures.

5. Application

Classroom Response System is utilized across a broad range of industries and organizations. A few examples include:

- Education
- Corporate training
- Control self-assessment
- Delegate voting
- Public participation in municipal or environmental planning
- Market research
- Decision support
- Game shows e.g. Audience Polling in 'Who Wants to be Millionaire'
- Conferences and events
- Executive decision making

6. Alternative

An alternative approach to this project would include an ArduinoBT board, which would act as a Response Device for the students without a mobile phone. Since the board supports Bluetooth communication with the PC, the interfacing of it would enable the students to send responses via Bluetooth. To implement this, 4 switches would be connected to the board and the responses would be keyed-in using them.

7. Future Scope

This project can further be developed to integrate the feature of identifying the location of the student in the classroom and to display the results in the form of a map, thereby allowing the Professor to get to know the 'Areas of Maximum Attentiveness' as well as the 'Areas of Inconsiderate Students'.

An add-on to the 'Classroom Response System' could be the 'Attendance System' wherein the attendance of the students in the classroom would be taken along with the responses.

Acknowledgement

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References

- [1] Sing Li and Jonathan Knudsen, "Beginning J2ME-From Novice to Professional", third edition, pp. 195-215.
- [2] James Keogh, "The Complete Reference-J2ME", pp. 95-212.
- [3] Bruce Hopkins, "Bluetooth for Java"
- [4] <http://www.einstruction.com>.
- [5] <http://www.iclicker.com>
- [6] <http://www.bluetooth.com>
- [7] <http://www.howstuffworks.com>
- [8] <http://www.wirelessdevnet.com/channels/bluetooth/features/bluetooth.html>
- [9] <http://www.oracle.com/technetwork/java/javame/index.html>
- [10] <http://www.ibm.com/developerworks/java/tutorials/wi-smart/>
- [11] <http://www.roseindia.net/j2me/>

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