Tracking Student Participation in Large Classes

Task Analysis

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1. List Of Tasks

A. A student wishes to communicate to the instructor that he or she wishes to a) ask a question of the instructor, or b) respond to a question posed by the instructor. (Easy)

B. The instructor needs to see when one or more students wish to speak, either to ask a question or to respond to the instructor's question, and acknowledge the student's wishes. (Medium)

C. The instructor wishes to record that a student has participated, as well as recording the quality of that student's participation. (Hard)

D. The instructor needs to see a representation of raw participation data, including number and quality of students' contributions. (Medium)

2. The Prototype

The prototype shown on the following pages is the core of the participation tracking system. Each student in a class where this system is being used would have his or her own remote, and the instructor is expected to have one computer available for this participation tracking software.

Figure 2.1 shows the main runtime window of the participation track system software. This window is displayed at all times during an actual class, and is used for evaluating student participation. In this window, whenever a student presses the volunteer button on their remote control, the student's name will pop up in one of the two columns. If a student presses their button unprompted (e.g. to ask a question or make a comment), their name, picture, and data will appear in the right column, marked "Question / Comment". If the instructor has asked a question and the student volunteers within a preset time, the student's name will appear in the left column, marked "Volunteer Pool".

The right column, which displays spontaneous volunteers, remains unsorted: The student who volunteers first remains on top and further students appear under the previous ones. For each name/picture combination that comes up, there is an individual text entry field and a submit button. After calling on the student, the instructor can rate the student's participation numerically and enter the value into the text field. Upon clicking the submit button, the value will be entered into the database and the name/picture box will disappear from the screen. The rest of the name/picture boxes in the list will move upwards appropriately.

The left column, used for instructor-prompted questions, can be sorted in four different ways. The four sort buttons are located at the top of the column. The students can be sorted by: The number of times they have volunteered, the number of times the have actually participated, the order in which they pressed their buttons, or randomly. In this column, as opposed to having individual submit buttons, there are two global "Submit / Flush" buttons: One at the top and one at the bottom of the column. These buttons submit the values in text fields into the database. Then all entries, evaluated or not, will be removed from the column. This is a way of declaring the whole question and answer period complete.

The "Results" button links to a second screen, which displays the contents of the database. These two screens share the same window, and so only one is visible at a time.

First is a picture of the entirety of the window, then parts of the window in different states.

Blue Letter Tags

A) This is the data for one student. It includes a picture, a name, the number of times a student has volunteered, and the number of times he has participated. This is displayed for every currently volunteered student.

B) This is the text entry field for a student's participation grade. This field is used to numerically rank a student's participation. Entering a number, however, does not immediately enter the value into the database. Also note: The values are only visible to the instructor, not the entire class.

C) This is the global "Submit / Flush" button for the "Volunteer Pool" column. It submits all

values entered into the text fields, and clears all students from the screen.

D) These are the four sort buttons to sort the left column. The sort methods are by: number of times volunteered ("#V" button), number of times participated ("#P" button), order of button press ("order" button), and random ("random" button). The sort type is remembered permanently, and does not only sort what is currently displayed. Clicking a first time sorts in descending order; a second time sorts in ascending order.

E) This is the individual submit button for a student who has spontaneously volunteered with a question or comment. Pressing this button submits the related value into the database and flushes the student off of the screen.

F) These are the two scroll bars for the two separate columns. Each column will be scrollable independently from the other. In addition, in the left column, the top and bottom rows that contain "Submit / Flush" and sort buttons will not move or scroll; Only the column's contents will be scrollable. Sort buttons and submit buttons remain constantly visible.

G) The Results button will lead to the results screen. The results screen will display a graph about the current student participation level. One can navigate/toggle from the Tracking screen to the Results Screen and vice versa. At all times the system can receive remote control signals, but the data will not be visible from the Results screen.

Figure 2.1: The center of our participation tracking software.

The circled letters are the Blue Letter Tags referred to in the preceding section.

Figure 2.2: The screen prior to any activity.

Sort Style: #V #P Order Rand

Results

Questions / Comments
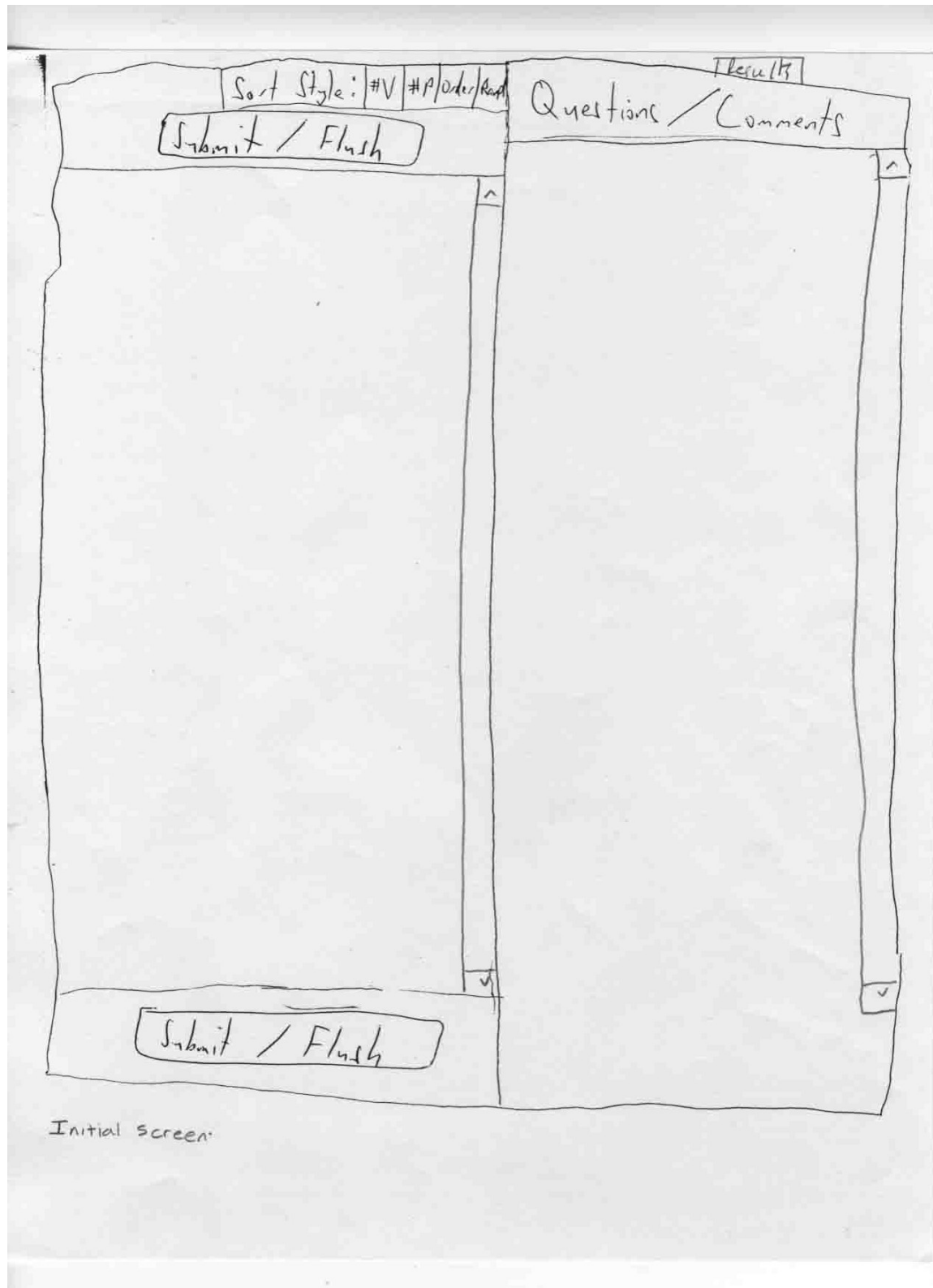
Submit / Flush

Submit / Flush

Initial screen.

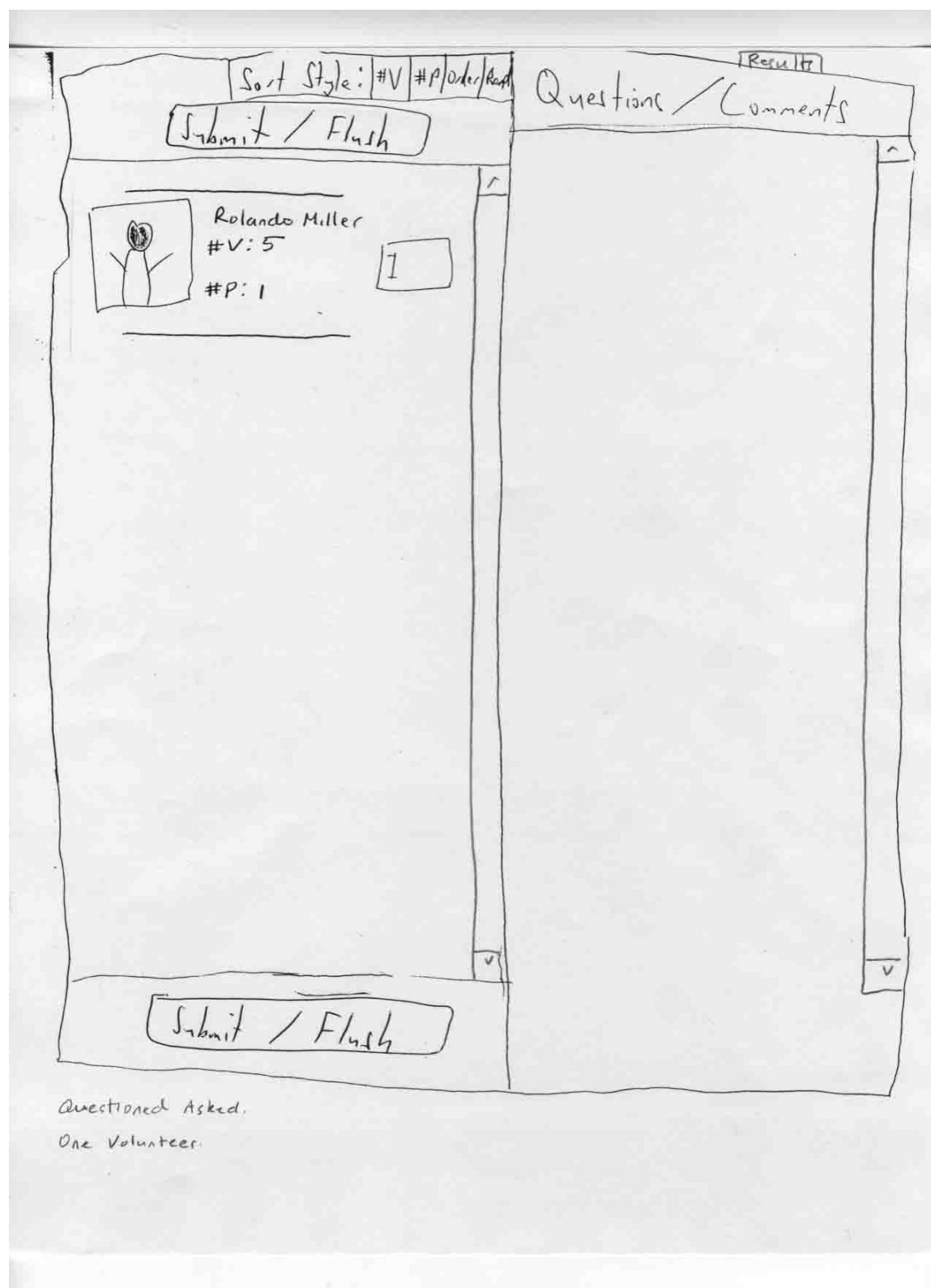**Figure 2.3: A question is posed by the instructor, and one student has pushed his remote control button.**

Figure 2.4: A question is posed by the instructor, and three students have pushed their remote control buttons. No sort is being used.

Sort Style: #V #P Order Raw

Submit / Flush

Questions / Comments

Results

Rolando Miller
#V: 5
#P: 1

1

Charlie Brown
#V: 2
#P: 4

4

Renee Ja
#V: 1
#P: 1

1

Submit / Flush

Questioned Asked
Multiple Volunteers
No sort

Figure 2.5: A question is posed by the instructor, and three students have pushed their remote control buttons. The instructor then clicked the #V button once.

Figure 2.6: A question is posed by the instructor, and three students have pushed their remote control buttons. The instructor then clicked the #V button twice.

Sort Style: #V #P Order Rank   Results

Questions / Comments

Submit / Flush

Renee Ja
#V: 1
#P: 1
It

Charlie Brown
#V: 2
#P: 4
It

Rolando Miller
#V: 5
#P: 1
I

Submit / Flush

Questioned Asked
Multiple Volunteers
Sort By: #V SecondClick

Figure 2.7: A question is posed by the instructor, and three students have pushed their remote control buttons. The instructor clicked the #V button once, then the #P button once.

Figure 2.8: A question is posed by the instructor, and three students have pushed their remote control buttons. The instructor clicked the #V button twice, then the #P button.

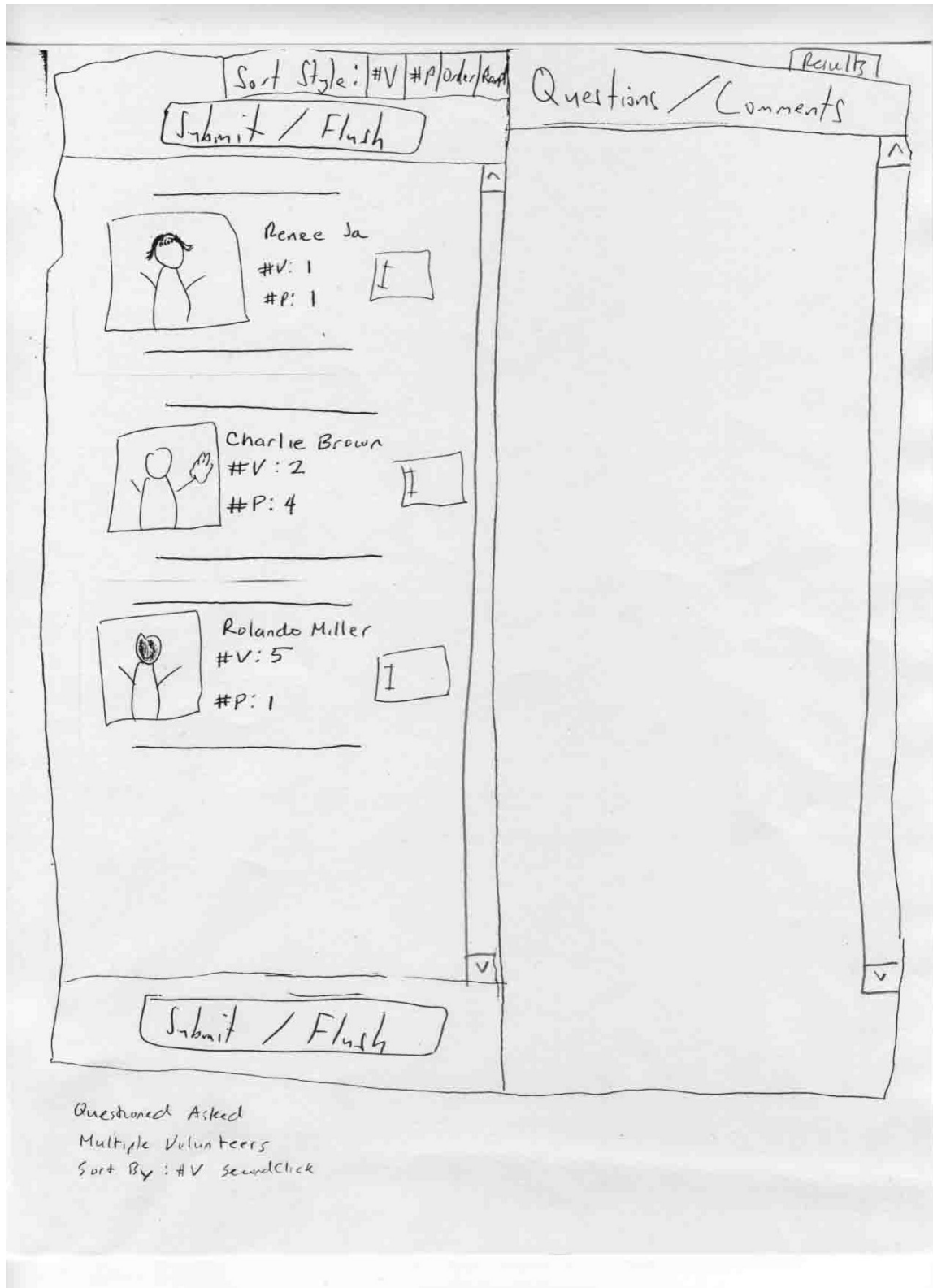**Figure 2.9: A question is posed by the instructor, and three students push their remote control buttons. The instructor clicked the #V button once, then the #P button twice.**

Figure 2.10: A question is posed by the instructor, and three students push their remote control buttons. The instructor clicked the #V button twice, then the #P button twice.

Figure 2.11: One student has pushed his remote control button, signifying that he wishes to ask a question or make a comment.
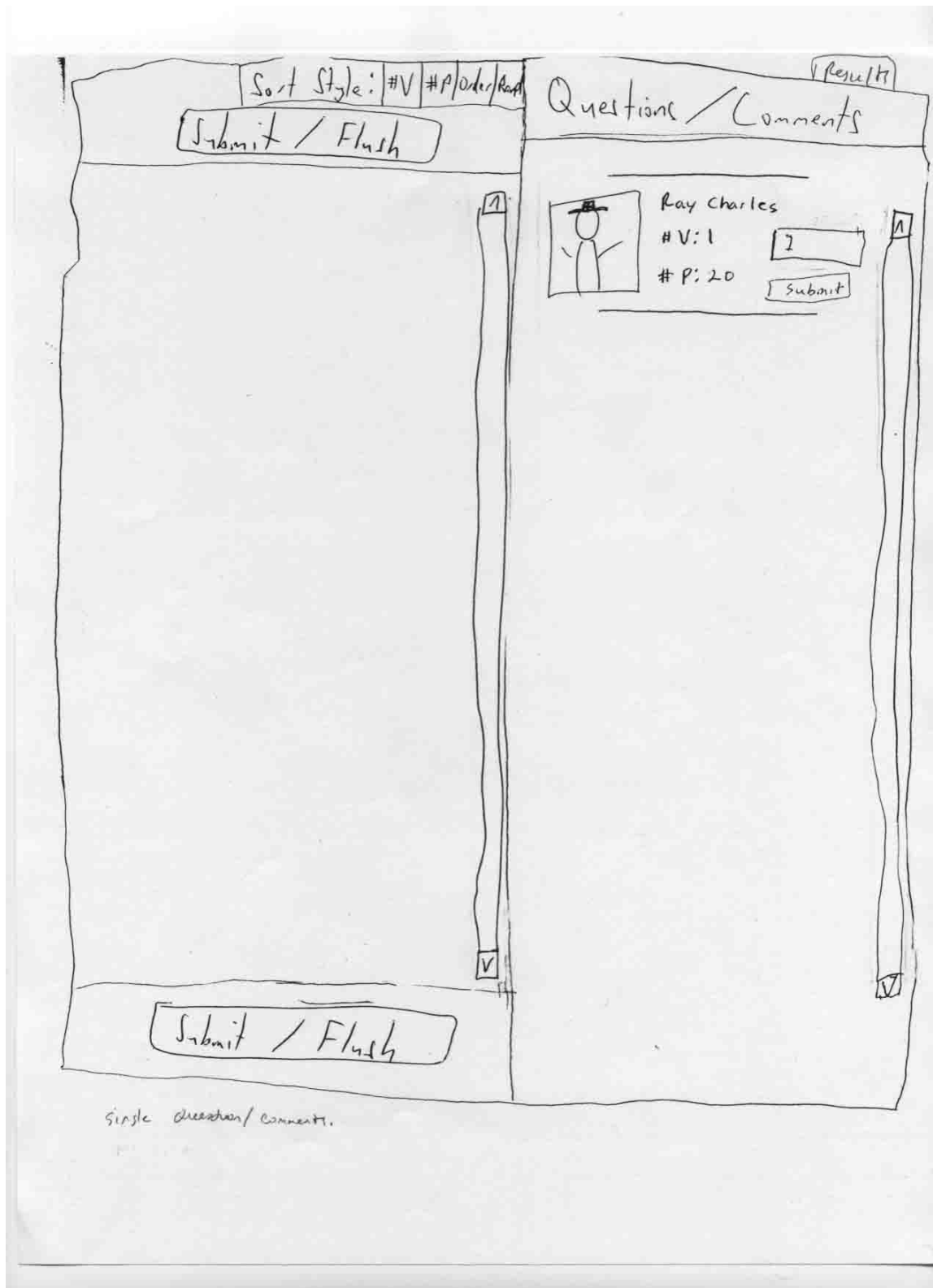
Figure 2.12: Three students have pushed their remote control buttons, signifying that they wish to ask questions or make comments.

Sort Style: #V #P Order Rand

Submit / Flush

Results

Questions / Comments

Ray Charles
#V: 1
#P: 20
Submit

Martin Barrientos
#V: 1
#P: 0
Submit

Brian Sanders
#V: 7
#P: 2
Submit

Submit / Flush

Multiple questions / Comments

Figure 2.13: From screen in figure 2.12, instructor enters value for Martin Barrientos' participation grade in the text field below the student's name, and clicks "Submit".

2.1 Design Iterations

Following is the iteration of earlier designs leading up to the final version of this prototype.

In Version I, all students, regardless of when or how they volunteered were displayed in the same column. In addition, every student, regardless of the group he belonged to, had his own submit button. It was thought that, for the people answering questions, one submit button would be best. This way, an instructor would not have to manually clear from his screen all the students he had not called on. Nor would he have to manually submit a possibly large amount of students that he had called on for just one question. Therefore, one group submit button was added to Version II.

In Version II, all students, regardless of when or how they volunteered were displayed in the same column. People answering questions were separated from spontaneous volunteers by a horizontal rule, with people answering questions at the bottom. It was thought that the two groups of volunteers were more easily distinguishable as distinct sets by putting them in separate columns. In Version III, this change is made.

In Version III, the "Submit / Flush" buttons and sort buttons scrolled along with the student data, and could scroll out of view. It was thought that these buttons should always be available, regardless of the place in the list the instructor is viewing. In the final version, these items are anchored to the top and bottom of the column.

Figure 2.14: First design for central screen.
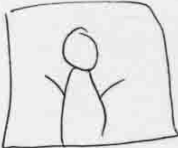
Figure 2.15: Second design for central screen.

Figure 2.16: Third design for central screen.

2.2 The Remote Control

The following prototype is a diagram of one remote control for the system. It is a simple and small unit. On it is a single button, taking up the majority of the face of the remote. This button, when pressed by a student, indicates that a student wants to volunteer, in either of the two categories. For an instructor's remote, it signals to the system that next predetermined period of time should be set aside for people to volunteer to answer questions. There is also an On/Off switch on the side of the unit. This is to conserve battery life when the unit it not in use. The whole unit should be small enough to fit into a person's palm.

Each unit has hardcoded into it a unique identification code, which the unit transmits to the system. This is used to distinguish students from each other, and identify the instructor. The unit utilizes one watch-type battery.

Blue Letter Tags

A) This is the single button, to submit a volunteer to the system.

B) This is the On/Off switch. In the on position, the button will function and transmit data. In the other, the system will be unresponsive, but not use battery life.

Figure 2.17: The remote control used by students.
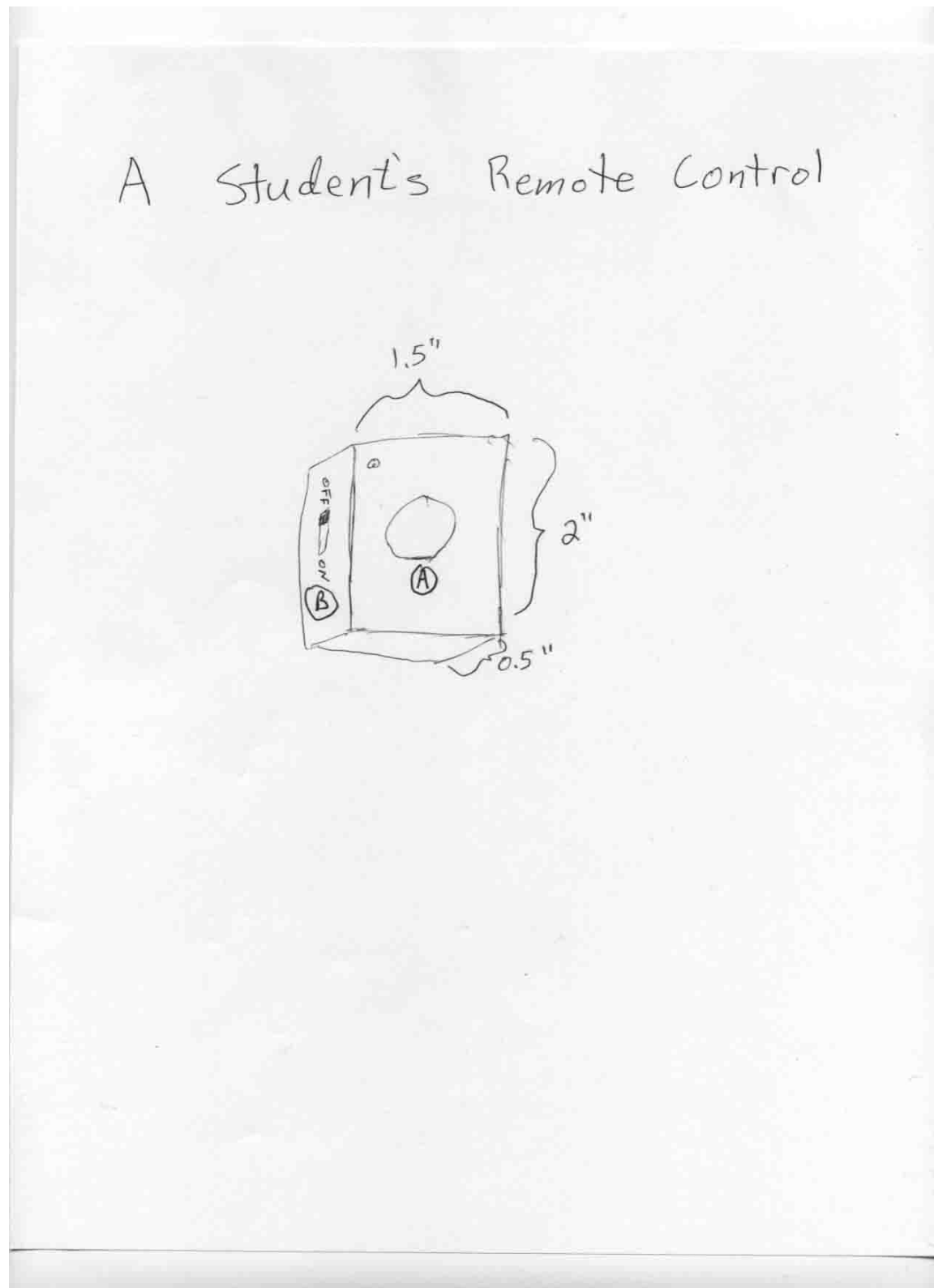
2.3 The Results Screen

The next diagram is of the Results window. This window can be displayed at any time, but will usually be called up by the instructor in his office or home, outside of class. This window displays the number of times each student has volunteered, the number of times they have participated, the average rating of their participations, and their total number of points. Clicking the heading of any of these columns will sort the table by that value.

At the bottom of the window is a synthesis of the data for the entire class. This row displays the average rating of a volunteer and the average total points of a student in the class.

There is a "Graph" button which will pop up a graphing screen, showing a curve for number of students vs data, for each value tracked. As opposed to the other two screens, which stay in the same window, the Graph screen will pop up in a new window.

In the state displayed in the prototype, five students are enrolled in the system, each with their own values.

There are several pictures of this screen, in several states of sorting and filling.

Blue Letter Tags

A) The Tracking button will bring the user back to the Tracking screen. It will pop up in this same window.

B) Heading buttons. Clicking any of the values which we track reorders the table to sort by that value. Clicking a first time sorts in descending order; a second time sorts in ascending order.

C) The Graph button will open a new window in which a line graph is drawn. This graph plots any value against the number of students that have each value.

D) At the bottom of the table, class averages will be displayed. Average rank/volunteer and average total/student are shown.

Figure 2.18: The Results screen, showing a spreadsheet of students' participation data. The circled letters are markers explained in the preceding section.

Figure 2.19: From screen in figure 2.18, the instructor clicks on the "Total Rank" column header.

	Participation Screen				GRAPH
SID	Name	#V	#P	Average Rank	Total Rank
4412	Chen John	5	7	3.5	24.5
1247	Brown Charlie	2	4	3	12
1237	Kuo Tim	6	2	4	8
2235	Miller Rolando	6	1	6	6
6679	Ja Renee	1	1	2	2
6678	Smith Mike	6	1	1	1

Class Total
52.5

Class Average.
8.75

Click on Total Rank Sort by TR.

Figure 2.20: From the screen in figure 2.18, the instructor clicks on "Average Rank" column header.

SID	Name	#V	#P	Average Rank	Total Rank
2235	Miller Rolando	5	1	7	5
1237	Kuo Tim	10	2	4	8
4412	Chen John	8	7	3.5	24.5
1247	Brown Charlie	2	4	3	12
6679	Ja Renee	1	1	2	2
6678	Smith Mike	4	1	1	1

Participation Screen   GRAPH

Class Total
52.5
Class Average.
8.75

Click by Average Rank,   Sort by AR

Figure 2.21: From the screen in figure 2.18, instructor clicks "#P" column header. "#P" refers to the number of times a grade was recorded to signify that the student participated.

SID	Name	#V	#P	Average Rank	Total Rank
4412	Chen John	5	7	3.5	24.5
1347	Brown Charlie	2	4	3	12
1237	KUO Tim	10	2	4	8
2235	Miller Rolando	6	1	5	5
6678	Smith Mike	4	1	1	1
6679	Ju Renee	1	1	2	2

Participation Screen   GRAPH

Class Total
52.5
Class Average.
8.75

click on #P   Sort by #P

Figure 2.22: From the screen in figure 2.18, the instructor clicks the "#V" column header. "#V" refers to the number of times a student as volunteered to answer a question.

SID	Name	#V	#P	Average Rank	Total Rank
				Participation Screen	GRAPH
1337	Kuo Tim	10	2	4	8
4412	Chen John	6	7	3.5	24.5
2235	Miller Rolando	5	1	6	6
6678	Smith Mike	4	1	1	1
1247	Brown Charlie	2	4	3	12
6679	Jn Renee.	1	1	2	2

Class Total

52.5

Class Average.

8.75

Click on #V   Sort by #V

Figure 2.23: From the screen in figure 2.18, the instructor clicks on the "SID" column header. This sorts the data by student identification numbers.

SID	Name	#V	#P	Average Rank	Total Rank
				Participation Screen	GRAPH
1237	KUo Tim	10	2	4	8
1274	Brun Charlie	2	4	3	12
2235.	Milla Rolando	5	1	5	8
4412	Chen John	5	7	3.5	24.5
6678	Smith Mike	4	1	1	1
6679.	Ja Renee	1	1	2	2

Class Total

52.5

Class Average.

8.75

Click on SID   Sort by SID

Figure 2.24: From the screen in figure 2.18, the instructor clicks on the "Name" column header to sort the data by students' names.

SID	Name	#V	#P	Average Rank	Total Rank
1274	Brown Charlie	2	4	3	12
4412	Chen John	6	7	3.5	24.5
6679	Ja Renee	1	1	2	2
1237	Kuo Tim	10	2	4	8
2235	Miller Rolando	6	1	5	5
6678	Smith Mike	4	1	1	1

Participation Screen   GRAPH

Class Total
52.5
Class Average.
8.75

click on Name   Sort by name

2.4 The Graph Window

       This final diagram is of the Graph window. This window displays visual graphs of data. It plots the value against the number of students with each value. This allows the instructor to find things like class curves.

Blue Lettered Tags

A) These buttons change the value that is currently being sorted by. The graph will clear and redisplay as needed.

B) This is the graph itself. Curves will be plotted using whatever values are specified.

Figure 2.25: From any of the screens in figures 2.18-2.24, the "Graph" button is clicked by the instructor. The first graph shown indicates overall participation as a function of time.
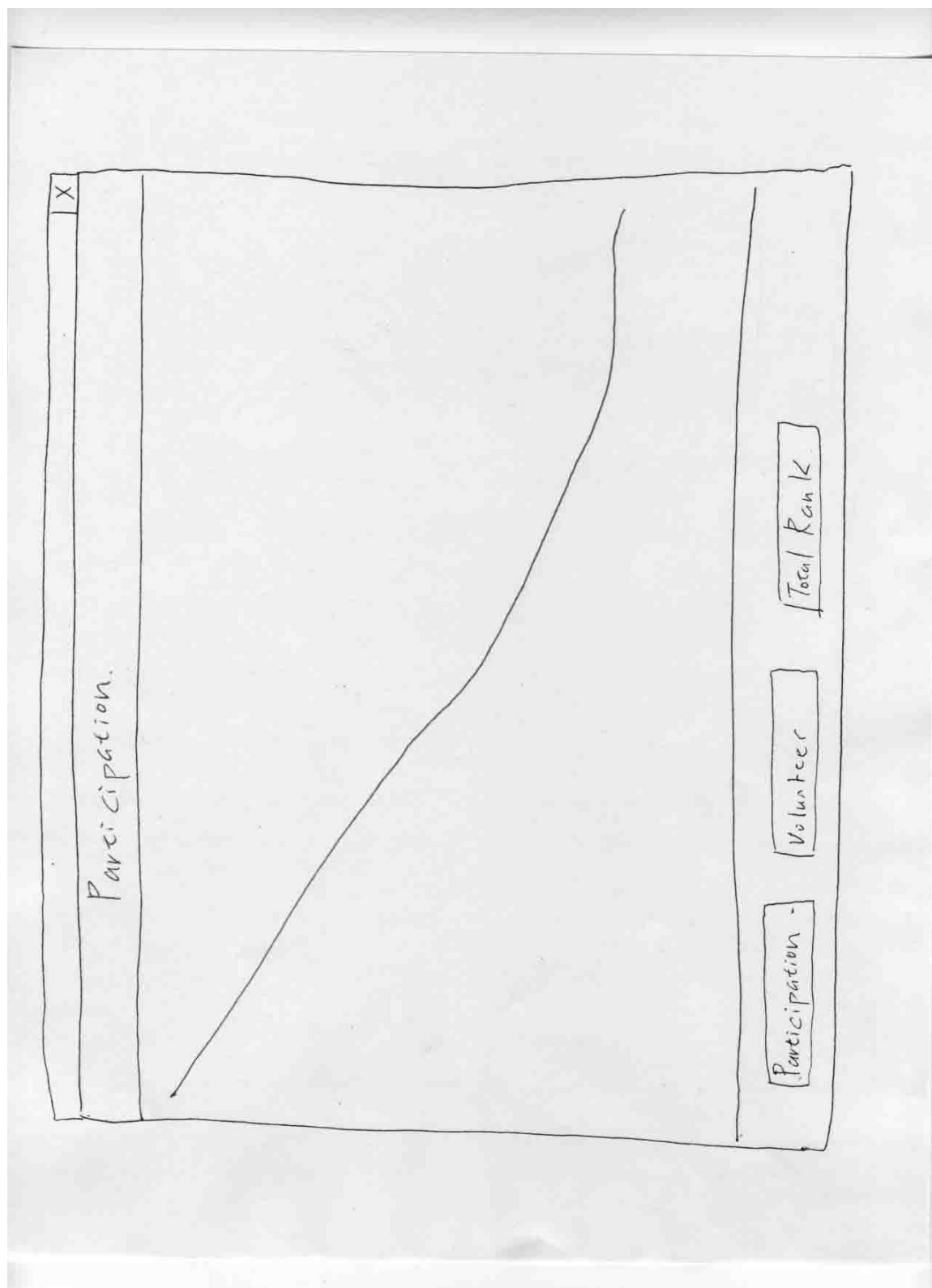
Figure 2.26: From the screen in figure 2.25, the instructor clicks the "Volunteer" button. This shows the overall rate of volunteerism as a function of time.
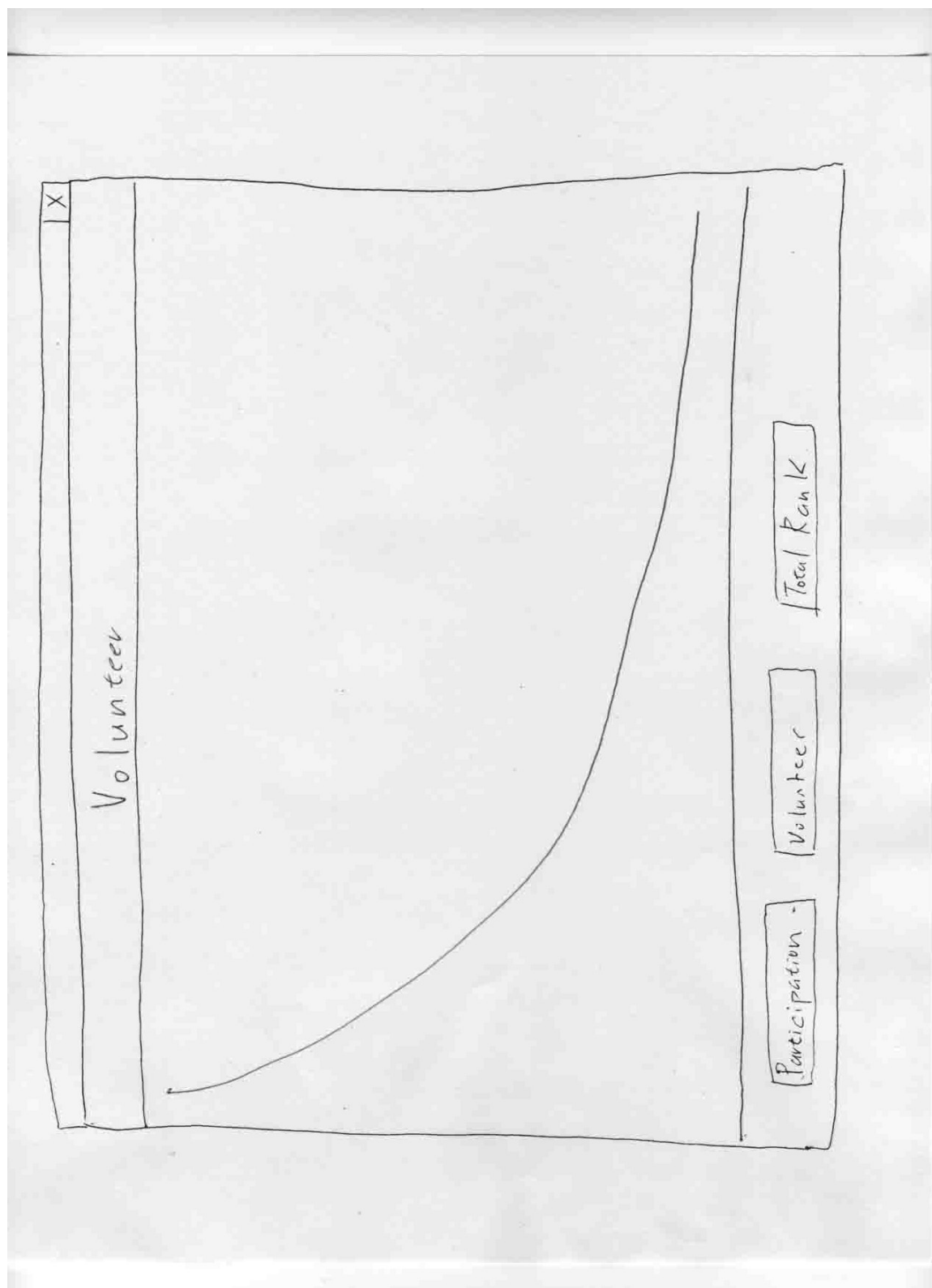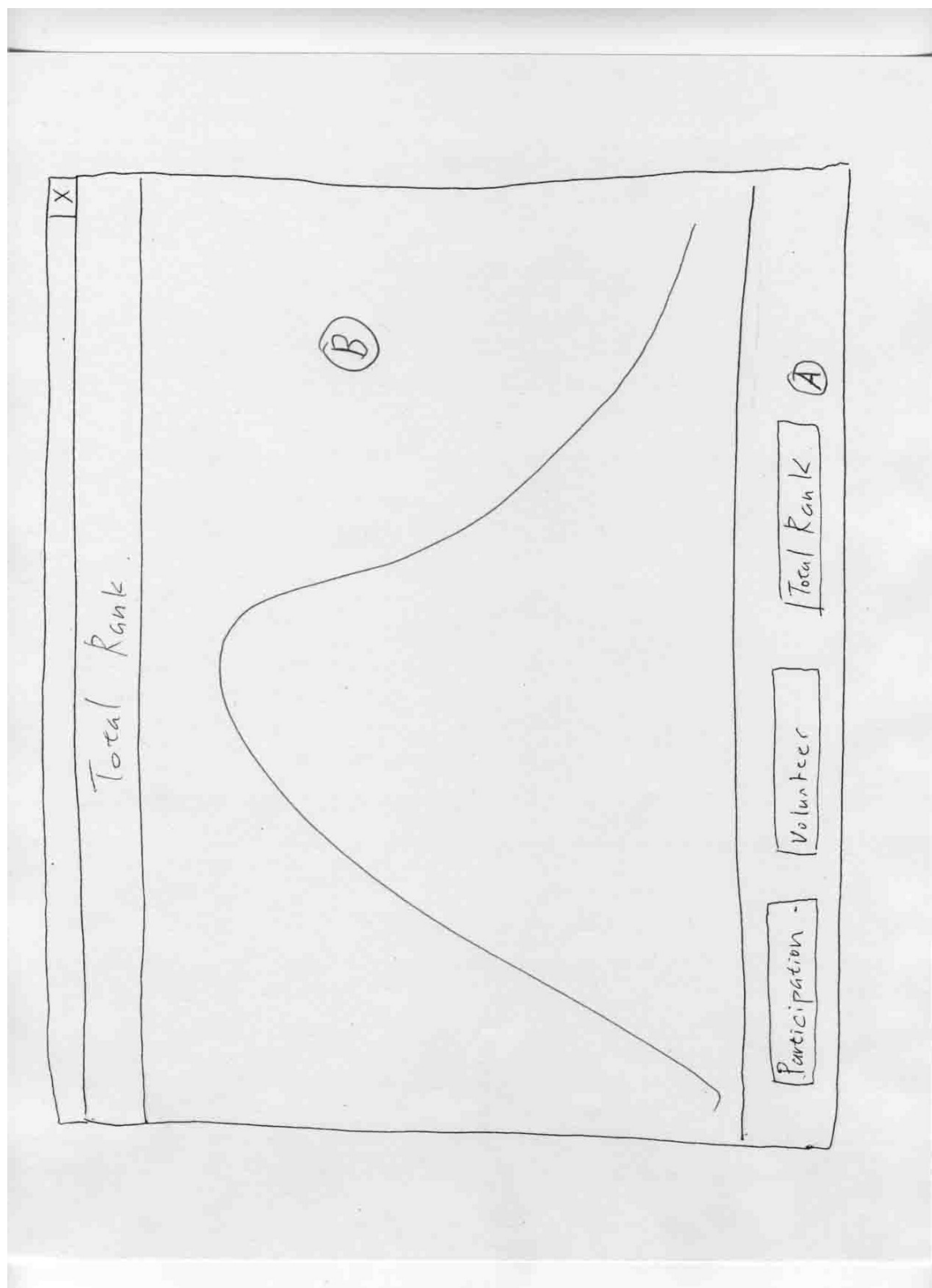
Figure 2.27: From the screen in figure 2.25, the instructor clicks the "Total Rank" button. This shows the overall total rank as a function of time.

3. Design Rationales

Student Ranking Screen (Prototype #1):

The data displayed for a student is designed to be as succinct as possible. The picture is there to confirm that the student speaking actually is the student being rewarded with the points. It also allows the instructor to find the actual student faster. The name is required to call on someone. Number of times volunteered and participated are there for the instructor's knowledge in order to allow the instructor to pick whoever he wants for personal reasons as well. It was also thought that, if we are sorting by these traits, it was best to show them explicitly.

It was thought that text entry fields would be the best way to enter participation ranking for several reasons. Firstly, a numeric system seems most intuitive for users to work with. A system using words instead leads to ambiguities and room for interpretation. ("Good" may not mean the same thing to one as to another.) Instead of a single text box, five numbered buttons were considered, numbered one through five. Instead of entering a value into a text box, the user could have clicked the number of his rating. This system, however, was too limiting, as a user could not specify a maximum rating. In addition, it was thought to be much faster and smoother to use the keyboard or number pad to enter data. A user can use the Tab Key to curse from one box to the next instead of having to manipulate the mouse.

The global "Submit / Flush" button is a much faster way to enter values than using individual buttons. This is an intuitive way for an instructor to declare a question complete. In addition, it removes the need to clear out every not-called-on student. This seems to be the fastest way to deal with groups of people volunteering at once.

The individual Submit buttons are used for students volunteering independently. This way, an instructor can rank and flush out a single volunteer, one by one. This is really the only way to rank a single student, that has no relation to any other. This allows the instructor to call on one student and continue, without having to call on every student that has volunteered at one time.

Finally, the scroll bars allow the instructor to see any student he wishes, regardless of the sort method chosen. Thus, the instructor is free to grant points to any student in the list. The "Submit / Flush" buttons and sort buttons are anchored to the top and bottom of the column in order to keep them visible. Regardless of who the instructor is currently looking at or how many people have volunteered, he should always be able to reach these functions.

Remote Control (Prototype #2)

The single button is used for either type of volunteering. A two button remote was considered, but being that the one button could be easily flagged by another remote, it was done away with. An additional button would only increase the cost of the unit.

The on/off switch is just a convenience, to save batteries. When the unit is not in use, there is no reason it should consume battery life.

Finally, the choice to hardcode the unit with its unique identifier was difficult. In the end, this choice again decreases the cost of the unit. We can do away with a card scanner on it, or a numeric keypad. It simplifies the look and use of the unit, making it less intimidating, perhaps more natural. To register people into the system, we can just enter them at the start of the semester, either manually by typing the numbers in, or by flagging the system with a time to register, when every student clicks their button once.

Result Screen (Prototype #3)

This screen is a simple numerical table displaying the database's contents. It displays both student individual values and the class averages. These values can be used at the end of a semester to determine final grades based on what the average participation was. A class curve can be set based on this data.

Graph Screen (Prototype #4)

This screen is another representation of the data from the Result screen. This just adds another level of understanding to the data. The instructor can quickly see trends, the average values of the class, and the extremes of the data. This can be used as a quick way to determine grading curves, based loosely on the curve of the data itself. Letter grades can be applied to the class more easily this way.