Pi Floor
Portable
Interactive floor
for Educational games

City for Scientific Research and Technological Applications (SRTA-City)

Ahmed Hamdy Mahmoud
Faculty of Engineering,
Alexandria University
ahmedhamdyau@gmail.com

Yara Abdullatif
Faculty of Engineering,
Alexandria University
yara.m.abdullatif@gmail.com

Shaimaa Lazem
SRTA-City
slazem@srtacity.sci.eg

Summary

This is a prototype of an educational interactive floor system using an Android phone and printed papers.

Abstract

Merging gaming in education produces sweet results for both the students and the teachers. Children nowadays tend to use mobile devices for a big amount of time and don't tend to do physical activities.

Interactive floors urge students to do move while learning. Nonetheless, most floor designs require expensive or extensive setup to operate.

We present the design and implementation of a prototype of an educational interactive floor utilizing only printed sheets of paper and an android phone. The design is optimized towards being minimal. Which makes it usable, affordable and in budget for students in poorer areas.

Initial results using the prototype provided satisfactory results where the responsiveness level is very close to real-time. However, this is still a work in progress project. Involving students in future experiments is a must.

Problem

Although many interactive floor systems exist in the literature, they have at least one of those deficiencies

High Cost
Extensive setup

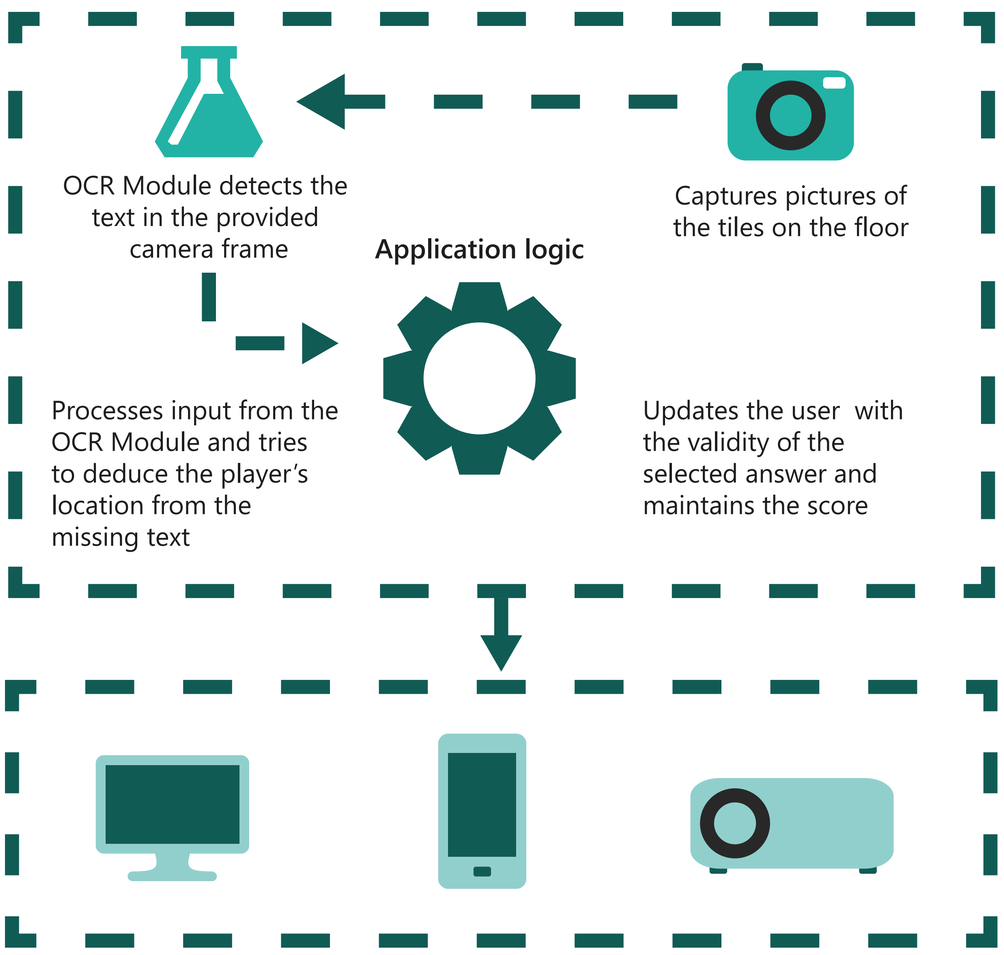
Process

Once the tiles are on the floor [1], the teacher launches the "Calibration Mode" of the application, in which the teacher selects the texts that appear on each tile as [2]. Once a teacher selects a text, it'll turn green meaning that it's saved.
This mode makes detection more accurate as noisy readings may cause text to change, calibrating the grid will make the app ignore any non calibrated readings.

After cailbrating the tile texts, the user switches to "Game Mode" where the app starts monitoring the text in camera images. Students stand on a tile to mark their answer, this will cause the text to disappear from the image and then the application will deduce the student's answer (which is the missing text).

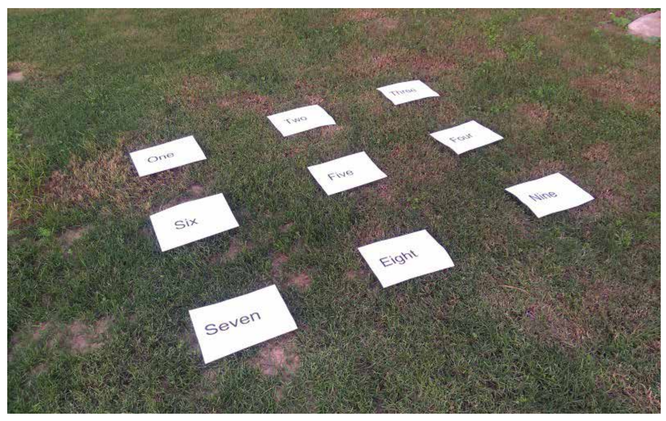
The teacher/other students can access a web page using the IP that appears as in [2] to view the player's progress. The teacher uploads questions through this page.

The user interface [3] is updated whenever the answer changes. If the answer is correct, the answer turns to green and red otherwise.

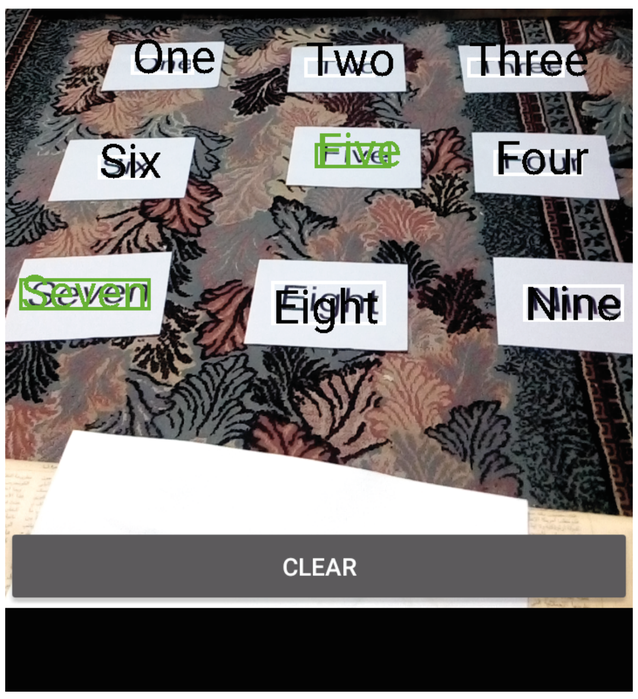


The User interface can be displayed on a range of devices because it is completely decoupled from the android app implementation.

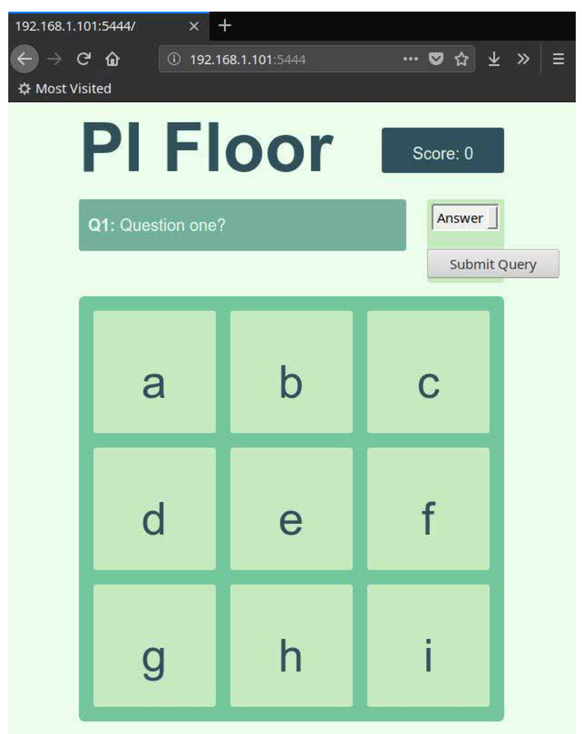
It's basically a website that the Android application hosts (no external servers needed), end devices fetch the website from the Android app.



[1] Game tiles printed papers are used to denote the game grid. The OCR module scans the text and stores it in an internal structure in the app.



[2] Calibration mode is a step before starting the game to reduce the level of error during the game by pre-determining the tile texts.



[3] User Interface is the view that displays the questions, answers and player score.

FAQs

Do you need light calibration?

No, we use Google's Mobile Vision API which is reliable even in poor light conditions.

What's next?

Right now, we need to work on responsivess, migrate to ML Kit and make the application ready for deployment.

Later, we'd like to have multi-player support.

What if 2 tiles were covered?

The application compares the Y-Coordinate of the 2 tiles and selects the one that's closer to the camera (less Y value).

What happens you don't have a projector / display?

Any device can access the User Interface using the device IP that's displayed when game mode is active.
So, smart phones of other students can be used to watch the player's progress.

References

Code with us:
https://github.com/shakram02/PiFloor

Google Mobile Vision API
(will be moved to ML Kit soon)
https://developers.google.com/vision/