RFID-based Orienteering Application for Smartphones

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Poika will be in South Korea until the end of the year. Weekly meetings are possible, but must take place on Skype or other video-conferencing systems.

Introduction

Orienteering is a sport where competitors are given a map with marked points (controls) to visit in a given order. The task is to do this as fast as possible. Modes of transportation may vary, but the most popular competitions require the participants to travel on foot. There are about 13000 active competitors in Finland. In addition there are non-competitive fitness events that attract about 400 000 participants annually. Including training events by clubs, the total number of orienteering events is probably a few thousand every year in Finland.

Organizing events requires drawing the map, marking the controls on it (correctly) and taking punching units to these places in the terrain. In busy locations the punching units must be guarded against theft and vandalism. Maps are usually printed on laser printers or with "real" printing machines for larger competitions.

In the old days the punching was implemented with cards and punching units that made hole patterns in them. Nowadays electronic punching is used. There are three major manufacturers for these systems. In Finland and Norway the Norwegian Emit system is dominant. Sweden and most of the rest of the world use the SportIdent system. Northwest Russia utilizes the SFR system.

RFID is the typical choice for epunching systems. The way that the RFID-based systems (e.g. SportIdent and SFR) work is that the competitor carries the RFID chip and the control boxes write their codes and timestamps on it. Punching systems are not easily changed. For example about 100000 emit cards have been sold. The owners will be very unhappy if they are suddenly told to buy new cards. A system with cheap control units and carried units that everybody already owns would be ideal.

The iOrienteering app solves the problem with CR-tags and camera. However iOrienteering relies on paper maps.

Suggested design

The design of the typical RFID-based systems will be reversed. The cheap tags will be on the controls. The competitor carries a smartphone with Near Field Communication (NFC) capability that can read passive NFC tags. Given that smartphones with big enough display for map-based navigation must be carried, and that the timing system is difficult to make tamper-proof the system is not intended for serious competitions. Instead the intended audience is introductory events and fitness events. I.e. the typical user of the system is someone who has not yet acquired the timing chips, compasses, etc. used by more enthusiastic orienteering folks.

The permanent orienteering courses have their own logistic problems that the app can alleviate. Usually a user of a permanent course needs to find where the maps can be acquired, go there while the place is open, then go to the location of the track. It is simpler to go to the location of the track, touch the start tag and get going as soon as the map has downloaded.

Server
- A web server where an organizer can set up each event.
- The server receives and stores the results from the competitor's phones and displays the results with split times.
- The server also hosts the track descriptions (list of control codes) and the maps (JPEG images)
Minimal effort should be put to the server end. As long as the track download and result display works, rest can be left for later.

App
- Downloads the track description and map from the server (URL can be given in an RFID tag).
- Displays the map and compass on the orienteering display.
- When touches a tag on a control records the tag ID and timestamp.
- A special tag can be read that triggers the result upload to the server. This tag can be placed somewhere after the last control.
- The suggested platform for the app is Android.

Maps
- There are precise regulations regarding orienteering maps. For this project, however these can be mostly ignored. For example the control point description are not necessary.
- Orienteering maps exist for many areas around Tampere. They are usually owned by the towns and updated by the orienteering teams. Teams and schools would use these maps that conform to the orienteering map rules for their events. They are usually maintained in software called OCAD from where they can be exported in many formats.
- For development, any map will do. Opencyclemap and karttapaikka.fi will offer maps with sufficient quality for test runs.

Other issues
- Participation for the whole project group in one iltarasti event (maps and emit rental) will be reimbursed. Participation will give better understanding of the logistics of such events and samples of maps (you should take different courses to get examples of different maps).
- NFC capable phone will be provided if needed.
- NFC tags will be provided.
- The hardware needed for programming the tags will be provided if needed.
- Having a group member who knows orienteering would help. The app should support the development of good orienteering habits so that transition to proper competition maps, compasses and punching units is as effortless as possible.
- A central goal in the project is to reduce the manpower needed for organizing small orienteering events. The app should eliminate equipment rental, map printing and sales, and result booth personnel. Ideally one person should be able to set up and run the whole event in one afternoon, or even not be present after taking the tags to the forest.
- The result of the project should be available under an open software license that permits both further development as open software and as non-free commercial products.
- The nature of the project is prototyping. It is not clear that this kind of system will work well enough. Much depends on the interaction between the tag and the phone. If the NFC connection is fast and robust in varying weather conditions, then the system may be viable. Also, it is not known how well smartphone will work as a map and compass. If everything works out well, there may be further development. Otherwise not.