Track 2 "Pedestrian Dead Reckoning Positioning (on-site)"

I. Introduction

This document is intended to give a guideline on the technical description and criteria used to organize the Track 2 Pedestrian dead reckoning positioning (PDR) competitions. PDR is defined as a system estimating a person's current position by using a previously calculated position. During a decade, PDR systems have been implemented in many forms allowing a combination of sensors, body position where the sensor is attached, and algorithmic approaches. And its application area are widened from special purpose missions such as firefighter rescue and military operations to newly emerging technologies such as virtual reality. Therefore, it is very important to define common evaluation framework to compare the performances of quite different PDR systems. This track is organized in two reasons: First, through the competition, we can identify newly developed topmost approach in this area. Second, the common interest group in PDR can share the ideas and network for future collaboration.

II. Competition Goal

This competition track is to evaluate the performance of state-of-the-art of self-contained PDR solutions worldwide based on the inertial, magnetometer and barometer sensors, etc. under realistic walk environment. It is well known that PDR alone can offer good short to medium-term tracking of the pedestrian, but still the long-term use is quite challenging for many researchers. In this track, we evaluate PDR solutions based on the signals available to any type of body-worn/mounted sensors.

III. Main features of the competition (Track 2)

1. General

This track will be done on-site, where the IPIN 2017 main conference will be hold (detailed location of the competition site will be given later). Competing system should be engineered or implemented in a form of localization system that exploits MEMS sensors (such as inertial, compass and pressure sensors), without limits on the number of devices and the mounting position, too. Mobile laptop or tablet PC, etc. can be used to process the sensor data stream. Competitors will be provided a detailed map of the area, while the predefined path followed by the actor will not be disclosed to competitors before the application of the benchmarks. A competing system is carried by the competitor himself, and it should record the log file of estimated position and key point index. An actor from organizer side will accompany with the competitor, and will guide the tracking path and where the PDR system to record estimated position with key point index.

After completing the spanning path, the competitor should submit the log file (Please refer below section IV "Description of Output File") to competition organizers. Any kind of artificial data manipulation is not allowed. Final scores will be resulted by comparing the position errors between the estimated coordinates and the key point coordinates.

No instrumentation of the area by competitors is allowed. Straps or any other devices necessary for the actor to carry the sensors should be prepared by the competitors. Possible specific requirements of the proposed PDR system should be communicated with organizers at an early stage in order be approved and to make the necessary arrangements. For any technical inquiries please e-mail the competition chairs and the TPC chair.

2. Sensor Requirements

Competitors can use any of the COTS (Commercial off the Shelf) MEMS sensor or self-developed sensors. Sensors such as inertial, magnetometer, barometer, light and sound etc. can be used to estimate the position. Any kind of sensor manipulation system (mobile laptop, tablet, wired/wireless communication) is allowed for competitor convenience. In case of self-developed sensors, be sure that the sensor functions are verified well before you come to the competition site.

3. Measurement procedure

Before attending to the competition, the competitor should develop their own algorithm which manipulating real time data capture and processing with final result in the requested format of text file. There is no need to interface with the other program. The competitor who carries the user terminal, which is communicating with the MEMS sensor on the body, just press the 'space bar' to indicate whether the location is key point or not.

The score for each competing artefact will be evaluated in the course of the time slot assigned to each competitor. At the beginning of the time slot, the competing team will configure their artefact and deploy it on his/her body. The configuration time will be restricted within 20 minutes.

Subsequently, the competitor will start moving and the measurement will take place; during this phase the competitors will have the opportunity to perform only short reconfigurations of their systems, in the order of few seconds. The competitor walks at a natural pace along a loosely-defined reference path, equal for all competitors. The path connects some tens of key points. When the competitor and actor pass through these key points, the competitor will set a time mark using his/her implemented application. The list of time marks together with the ID and positions of the key points will be the ground truth used to compute the localization errors.

Coordinates will need to be stored in the WGS84 coordinate system (longitude and latitude) for x, y, and the floor number (an integer starting from 0) or altitude in the unit of meters for z. The timestamp should be in milliseconds from the epoch, retrieved from currentTimeMillis().

The path followed by the person will be approximately the same for each test, will take approximately the same time and will pass through all the key points in the same order. It may include pauses, loops and any kind of natural movement. It will be disclosed to competitors few days before the competition.

IV. Description of Output File (Logfile)

For each trial, you must submit the following form of text file (.txt), containing estimated position and the indices representing the key points in the following format.

Logfile Data Format

utctimestamp	longitude	latitude	z	index
1474467302226	-3.349986	40.512979	2	0
1474467306183	-3.349933	40.513032	2	0
1474467306818	-3.349938	40.513009	2	0
1474467310484	-3.349971	40.513026	2	0
1474467311335	-3.349936	40.513039	2	0
1474467311505	-3.349956	40.513054	2	0
1474467312989	-3.349981	40.513021	2	0
1474467316923	-3.350020	40.513058	2	1
1474467320042	-3.350028	40.513044	2	0
1474467320498	-3.349977	40.513056	2	0
1474467321243	-3.349944	40.513024	2	0
1474467323071	-3.350048	40.513055	2	0
1474467323445	-3.349953	40.513071	2	0
1474467324326	-3.350036	40.513069	2	0
1474467325220	-3.350020	40.513040	2	0
1474467328625	-3.350068	40.513062	2	2
1474467332762	-3.350056	40.513071	2	0
1474467334013	-3.350011	40.513056	2	0
1474467336068	-3.350035	40.513064	2	0
1474467336456	-3.350099	40.513026	2	0
1474467337409	-3.350104	40.513067	2	3
1474467341777	-3.350136	40.513056	2	0
1474467342879	-3.350177	40.513067	2	0
1474467343293	-3.350150	40.513046	2	0
1474467345487	-3.350128	40.513043	2	0
1474467346904	-3.350161	40.513041	2	4
1474467350312	-3.350164	40.513011	2	0
1474467352210	-3.350267	40.512991	2	0
1474467353524	-3.350188	40.513026	2	0
1474467354489	-3.350301	40.512965	2	0
1474467354986	-3.350200	40.512988	2	5
1474467359579	-3.350153	40.513056	2	0
1474467359936	-3.350289	40.512974	2	0
1474467360855	-3.350278	40.513013	2	0
1474467362507	-3.350224	40.513024	2	0
1474467363890	-3.350170	40.513073	2	0
1474467365506	-3.350163	40.513019	2	6
1474467369911	-3.350132	40.513042	2	0
1474467370980	-3.350151	40.513058	2	0
1474467371232	-3.350131	40.513045	2	0
1474467371324	-3.350178	40.513057	2	0
1474467371444	-3.350128	40.513050	2	0
1474467371615	-3.350091	40.513052	2	0
1474467378302	-3.350163	40.513065	2	7
1474467381720	-3.350133	40.513080	2	0
1474467381733	-3.350157	40.513106	2	0
1474467381884	-3.350154	40.513088	2	0
1474467382476	-3.350149	40.513138	2	0
1474467382807	-3.350175	40.513106	2	0
1474467387169	-3.350245	40.513142	2	0
1474467388624	-3.350322	40.513155	2	8
1474467390548	-3.350231	40.513148	2	0

> ...

*Note:
1. utctimestamp represent the time of your local machine when you take the data entry
2. utctimestamp is in utctimestamp format.
3. longitude and latitude are the estimated position at the time based on your algorithm. 'z' means a floor number the competing system identifies.
4. 'index' represents the key point number from 1 to N (integer). 0 represents no land mark. Each specific integer represents the specific key point.

**Note:
1. Evaluation will be proceeded with the estimated position at each indexed key point position.

V. Evaluation criterion

The accuracy score will be the third quartile of the localization errors at the key points. The localization error is the Euclidean distance between the competitor's estimate and the real position of a key point.

The error will be measured based on **xy** coordinates (longitude and latitude). To this, a penalty P = 15 m will be added for each floor error. For example, if the xy error is 4 m and the estimated floor is 2 while it should be 0, the computed error for that estimate will be 4 + 2P = 34 m.

Competitors for which the third quartile of error is greater than 25 m are not eligible for the winner prize.

Final scores will be disclosed at the end of the competition, and the competing systems ranked according to this final score. Additional details on the evaluation criteria will be provided as part of this document.

VI. Organizational aspects

The coordinates of the starting point for the path will be provided the day of the competition, at least half an hour before the competition starts. You will have at least a full day before the competition to survey the area yourself, take measurements where needed and make measurements of the network signals.

A number of markers will be put on the floor. You cannot tune your application after the official start of the competition. However, if you notice that things are clearly going wrong in your application (crashing, for example), you may ask for a second chance, which will be normally given if time permits. In any case, the path will be run twice for all competitors, and the best result will be retained.

All competitors in track 2 are NOT required to integrate their application with the dedicated application that we use. We need only a final result text file which is formatted as organizer's request. We are sure this approach can reduce the time of environmental setting and interfacing between the competitor's application and organizer's application.

Contact Information

For any question about this competition track, please write to the

contest@evaal.aaloa.org mailing list.

If you need a private contact, you can write to

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