

Logistics project description

Dispatch strategies for cardiac arrest volunteers

Background

The number of initiatives utilizing volunteers as additional resources when dealing with emergencies and disasters keep growing. The benefits are many and the cost is low, but there are also a set of challenges, including the uncertain availability, capability and response time of the volunteers.

Examples include SMS lifesavers (<https://heartrunner.com/>) who are mobile phone dispatched volunteers to out-of-hospital cardiac arrest (OHCA) cases. When there is an OHCA case, a notification is sent to a number (e.g., 30) of volunteers close to the patient. They will be assigned either to go directly to the patient or to pick up an automated external defibrillator (AED) on the way to the patient. The setting is highly stochastic, including the probability that a volunteer will accept the mission, how long time it will take to go to the patient, if an AED is accessible, how long time it will take to pick it up, if the volunteer indeed will pick it up if instructed to do so, and if they will finish their assignment (i.e., not aborting the task mid-way).

There are several possible strategies when deciding how to dispatch the volunteers. It is possible to pre-determine assignments for all of them before sending the alert, or wait until they have confirmed that they will respond. Several volunteers can be sent to pick up the same AED, to increase the probability that it will be delivered, or you can assign just one volunteer to pick up a specific AED, if the chance is high that (s)he will indeed fetch it. There are several ways of prioritizing between dispatching volunteers to go directly to the patient and start cardiopulmonary resuscitation (CPR), or to take a longer time picking up an AED on the way.

Aim

The aim is to analyze the current way of dispatching volunteers in the Heartrunner system, suggest strategies for improved dispatching, and computationally confirm that the new strategies will improve the system.

Historical data for previous volunteer responses, including positions of the volunteers on their way to the patient will be made available.

Organization

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Project group

The project should be conducted by a group of 3-5 students.

Project description

The project covers the following steps:

- Make a literature survey of similar initiatives and related areas.
- Survey and analyze the current way of dispatching, by interviewing Hearrunner personnel (contacts are already established) and investigating historical data.
- Construct a set of key performance indicators that can be used to evaluate different dispatch strategies. Validate these with Hearrunner personnel.
- Suggest new, improved strategies.
- Construct a mathematical model for evaluating the dispatch strategies.
- Compare current way of dispatching with the new improved strategies.
- Analyze the results.

Project grading

Each project can be graded, Fail, 3, 4 or 5, or the corresponding ECTS grade. Each step below will be evaluated regarding the complexity, realization, systematic treatment of input data, modeling and output data.

For the grade 3, at least the following steps have to be carried out:

- A detailed project specification and time plan, carefully written in English.
- A literature survey of similar initiatives and related areas.
- A description of the current system and suggestion of at least one improvement.
- Construction of a mathematical model, and a comparison between the current and the improved strategies using at least one KPI.
- An analysis of the results.
- A final report carefully written in English and an oral presentation of the project results.

For the grade 4, the grade 3 steps have to be carried out with very good results and the following steps have to be carried out:

- Two KPIs and two improvement suggestions. The mathematical model takes into account at least one stochastic factor.

For the grade 5, the grade 3 and 4 steps have to be carried out with extremely good results and the following steps have to be carried out:

- Three KPIs and three improvement suggestions. The mathematical model takes into account at least two stochastic factors.