Distribution system of data transmission between mobile objects

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Today a lot of problems in different subjects are automated by software. And problems of obtaining, keeping and transmission information between mobile objects is no exception. The particular case of this task is transmission information between the nearest cars. For example, the car which is ahead can send information about quality of road to the nearest cars. This information can be processed by board computer which can decrease traffic accidents. Also another example of using this system can be shipping. Helpful information in this case can be information about environment like wind speed, value of waves, etc. So, we can conclude that these systems are very useful in different areas.

Such systems already exist, but they have several problems. First, it is their direction to one concrete subject area, for example, it can be auto industry. So, it is impossible to use system developing for auto in another area despite of retaining concept. Second, it is data transmission via mediator. It can decrease performance very much. For example, if we take this system which should work with cars in the center of a city, decreasing of its performance can be so much that the system will not transmit information on time. But it is not necessary to send data via some mediator. Third, almost all the existing systems require expensive equipment [1] like repeaters, laptops and other hardware. But it is not necessary to use special Wi-Fi routers, for example, if the car already has it. And fourth, these systems are not open. It makes integration new types of mobile objects and different systems very difficult because of closed protocols.

In table 1 there is analysis of some popular systems of transmission information between mobile objects.

Table 1. Analysis of some popular systems of transmission information between mobile objects

Criterion	System name				
	Iridium DTS	ACARS	BMW Connected Drive	Yandex Traffic	City Guide
Flexibility relative to subject area	-	-	-	-	-
Self-sufficiency	-	+	+	+	+
Transmission via mediator	+	+	-	+	+
Realization of open standard	+	-	+	+	+
Cross platform	-	-	-	+	+
Technical documentation in free access	-	+	-	-	-

So, there is no system which is flexible relative to subject area, which can be modified for concrete subject area with minimal changes. And one of the considered systems hasn't functionality for transmission data

between mobile objects without other systems (Iridium DTS). All the considered systems except for BMW Connected Drive perform data transmission via central mediator which is a bad way for performance. Such systems just aggregate information and then send it to mobile objects on request. Another disadvantage except for ACARS is that they don't try to realize conception which can uniform transmission between mobile objects via defining of protocols, ways and technologies. Several systems are not cross platform. They are available only with special hardware parts.

It can be concluded that currently there is no system which is flexible relative to subject area and that transmits data directly from one mobile object to another furthermore which is cross platform and free. So, developing of this system is an actual problem in information technologies and beneficial activity from economical point of view.

On figure 1 there is a description of parts system which hasn't considered disadvantages. Based on figure, it can be concluded that the system has two modules – register and mobile object module. Mobile objects can interact between each other directly.

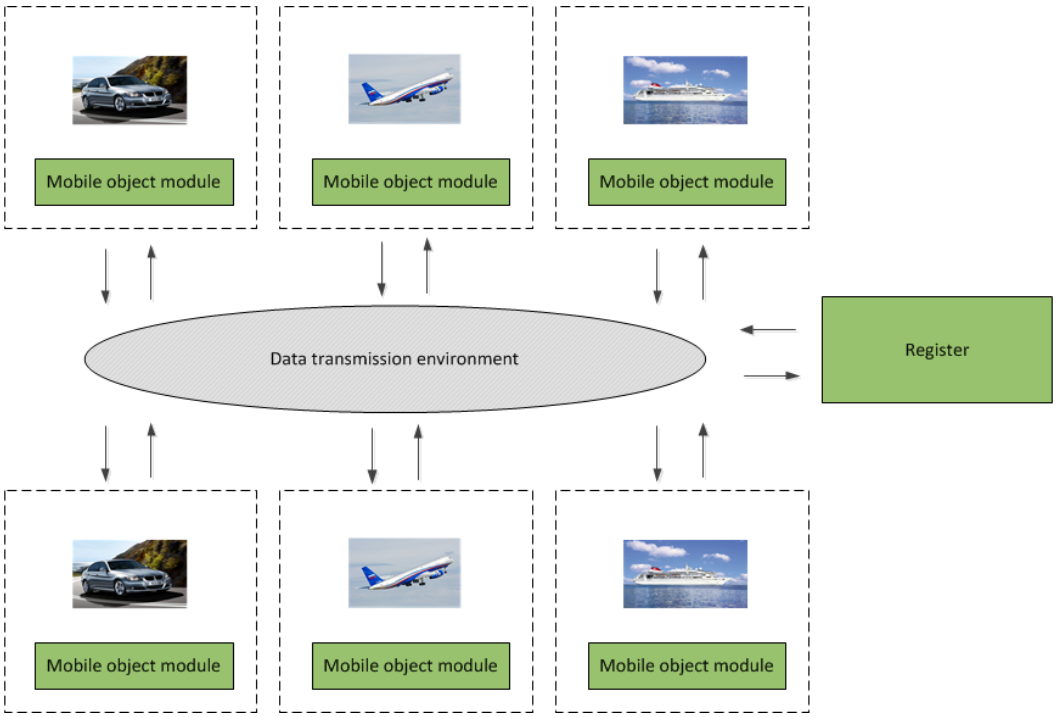

Figure 1. Description of distributed system of data transmission between mobile objects

Register is a central node which provides coordination of interaction between mobile objects. In such systems one of the main problems is the problem of defining such mobile objects which have useful and actual information for another mobile object. Problem is that a mobile object has at least two properties - state (coordinates and measures depending on subject area) and small computing resources (because of embedded systems are limited in resources, and one of the target platforms are embedded systems). So, because of the second property to solve this problem on each mobile object is not possible. Also, it is important to say that despite of the existing central node, data transmission via register is minimized. It keeps only the list of working mobile objects at time.

Let's consider a typical use case. Some mobile object makes request which is processed by register. If authentication is successful, request is performed by subsystem of register which provides searching of actual mobile objects with condition of usefulness. Next, the client receives the list of mobile objects with actual information and it starts interaction with them.

So register has next functions:

- authentication and authorization mobile objects;
- defining of actual mobile objects list for another mobile object;

- keeping list of currently working mobile objects;
- auto-removing information about not working mobile objects.

Mobile object module should be set up on each object. It can be auto or ship or some other. But it is always connected with board computer and sensors. Board computer is a controller which makes decisions about what should do the mobile object with the received information. It depends on the subject area and is connected with the module via abstract programming interface which encapsulated information about subject area. So, after receiving data mobile object module decodes data to the format which received interface of board computer. Independence of subject area is reached by this way.

Mobile object module has next functions:

- authentication and authorization mobile objects, which want to get measures;
- sending information to another mobile objects;
- forwarding measures from another mobile objects to board computer;
- getting information from sensors.

It is important to notice that the interaction between mobile objects has publish-subscribers model which provides one publisher to have several subscribers at the same time which get messages. This model prevents problems with performance. There is a logical scheme of messaging on figure 2.

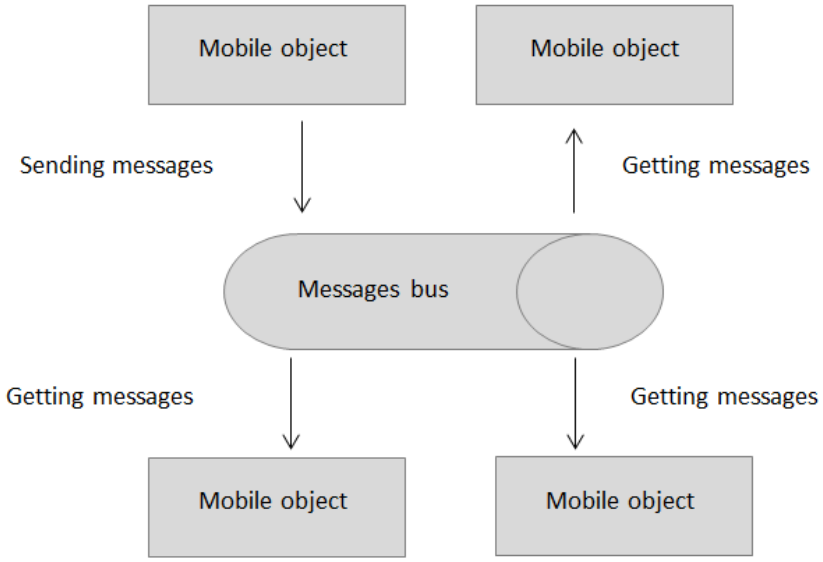

Figure 2. Logical scheme of messaging by publisher-subscribers model

Prototype of this system was developed with Java Enterprise stack of technologies because it has cross platform technologies which provide distributed data processing. For realization of interaction between mobile objects it was used Java Message Service specification with Apache ActiveMQ implementation which provides embedded message broker. Register was developed as Java web application for JBoss application server. For data keeping it was used MySQL but because of using object relational mapping approach system doesn't depend on database.

Implementation of condition which defines relevance of mobile objects use only coordinates of objects. In a future work it is planned to improve this component by integration of it with the third party systems and using algorithm of intelligent data processing. Besides, prototype use standard Java algorithm of serialization for messaging which can decrease the opportunity for integration with the third party systems. So, it is another problem which should be solved in future.

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