IOP Conf. Series: Materials Science and Engineering **106** (2016) 012010 doi:10.1088/1757-899X/106/1/012010

Research on models of biological systems that can be integrated into mechatronic systems

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Abstract. The models of biological systems that we find on Earth can be the subject of research to develop a few mechatronic systems. Such models are offered by bees, ants, crows, cranes, etc.
Article aims to investigate these models and their manifestations. Imitating this behavior and studied him offer ideas for develop models that can be integrated into mechatronic systems. They can be integrated into mechatronic system as algorithms for finding local optimum, to search, to detect an optimal way travel on a network, to find best decision, etc.

1. Introduction

It's easy to build a network of sensors that covers a certain area but it is very difficult to adapt to the environmental conditions for maximum efficiency operation. Problems related to: validate the measurement points, power supply, signal transmission, the degree of automation of the system, the influence of environmental factors in quality measurement, system maintenance, safety equipment, etc. Two models are the best candidates to be followed in the composition of the monitoring system: flocks of crows and central nervous system of the human body. Specifically the combination of these two models provides design, construction and successful operation of the system. Crows for their ability to orient themselves in their travels by detecting the location and trajectory adjustment according to information provided by other crows from the edge of the flock. But flock behavior according to information that is constantly updated during the trip. The central nervous system model is copied and adapted following functions: command and control, real time transfer of information and interfacing. The interface is based on the brain's ability to create virtual images of objects placed in crisis situations. The aim is to better manage information and eliminate redundant signals. It is a form of understanding of reality and communication with the environment.

For the most part of our existence we can make fairly accurate and precise forecasts about weather events on geographical areas. Weather radars, satellites and ground stations are helpful tools in collecting and processing field data needed in order to make the best prognosis. A variety of information is available via the Internet. Network interconnection ensures real-time data exchange and the correct information that lead to making the best decisions.

But unfortunately there are short time phenomena that occur on small areas. They cannot be predicted due to weather effects generated moments before its occurrence. An example of such effect is the thermal inversion effect or the massive floods that happen in a short period of time. How do we protect the assets and the population from such phenomena impossible to predict?

2. Flooding caused by short downpours on a small area

Such a phenomenon is the downpour, where enormous quantities of water fall over a short period of time on a less extensive surface. The application aims to monitor the water level of a river basin. Sensors are installed on the main river and on the main tributaries. They transmit data using GSM network (Figure 1) to a central server. This data is retrieved and compared with the data from the location where the sensor is located.

This method can provide information on sensor functionality. The data is then stored in an online database stored on the server (Figure 3). This model allows access to data history transmitted in a given time and space. This information can also be used to generate future models regarding the amount of water reaching the rivers from a certain surface, resulted from normal rains. Such data can be used in various further research.

Figure 1. GSM antenna

3. The database structure of the application

Database tables are interconnected so as to ensure optimal management of information [1-3]. They store information about the technical specifications of ground sensors: size measured, measuring interval, operating mode, etc. [4], [5] (Figure 2). The locations of the sensors are important to making the correlation between the size measured and the river location where the measurement is being performed. If data from a sensor repeatedly fails to be received, the information will not be filled in the database and the faulty sensor will be signaled in another section. The program will thus alert the administrator about the fault occurred as well as the location of the deffective sensor. These locations are stored and transmitted through the GPS coordinates system: latitude and longitude. For greater accuracy, along with these coordinates the database also stores the measurements of the riverbed at the location of the sensor.

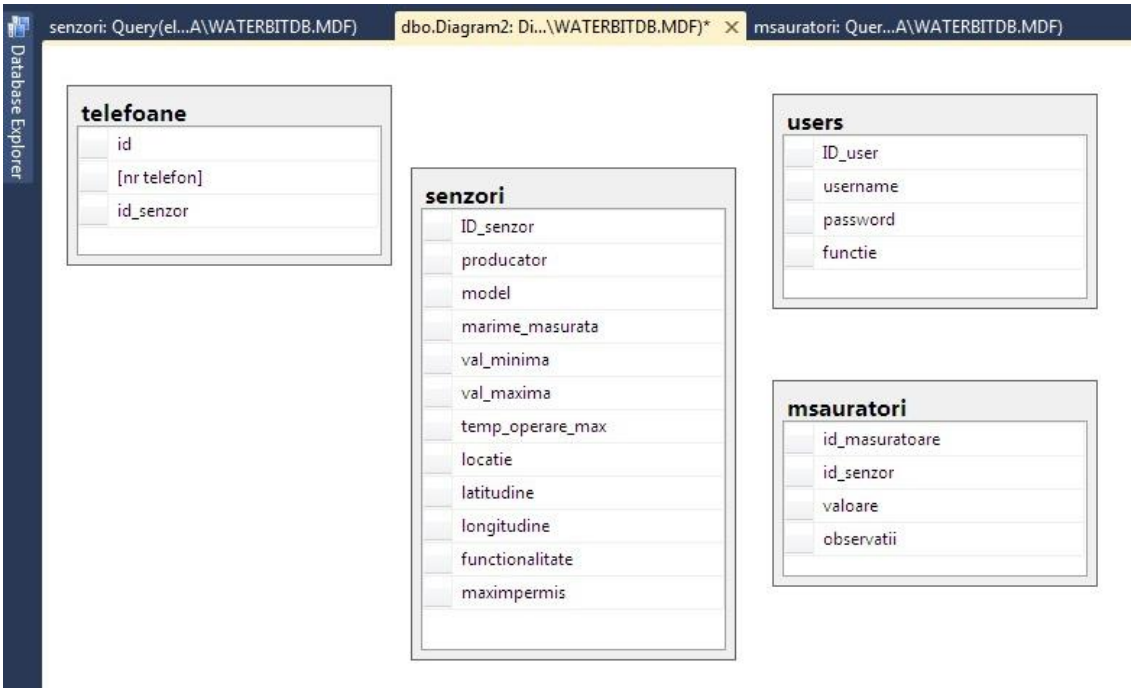

Figure 2. A part of diagram database apllication

4. Running the application

The program, which is installed on a PC, manages the information in the system, processes it and takes decisions. It is implemented using C # (Sharp) programming technology with an interactive graphical interface [6-9]. It benefits from access zones well defined between administrator, user and system operator (Figure 4). It enables the management and the usage of the integrated system, as well as the access to database information.

The moment the sensors register that the level of water is exceeded, the program launches the hazard alert. Alerting is done by using the GSM network for mobile telephony (Figure 1). The SMS (Texting) services of GSM network application send alert messages both to the local authorities in the endangered areas and to the population.

The application uses a database in which the contact information of local authorities and emergency intervention teams are stored. Alerting the population located in the risk area can be done in two ways. The alert message can be sent to the phone numbers stored in the database (Figure 2), or use the GSM antennas (Figure 1) in the endangered area to send the alert message to all the GSM users connected to the network in the range of the respective antenna (Figure 1).

5. Monitoring water chemistry

The application can also monitor the pollution of a river basin. The sensors placed in rivers may refer certain chemicals present in the water. They can send measured values to the database server using the telephone network. The program processes field data and decides the level of alert. Then it alerts the competent authorities and the population living along the area where the pollution will spread. This way one can precisely know the point of origin of the pollution, may establish its magnitude and also how it can be mitigated. It's important that the measures taken in order to reduce pollution impact on the environment be taken in the shortest time possible from the onset of pollution. Such a real time monitoring system is very useful.

id_masuratoare	id_senzor	valoare	observatii
1	1	51	Niciun pericol i...
2	2	52	Niciun pericol i...
3	1	51	Niciun pericol i...
4	2	52	Niciun pericol i...
5	1	300	Sansa de inund...
6	2	400	Niciun pericol i...
7	1	300	Sansa de inund...
8	2	400	Niciun pericol i...
9	1	300	Sansa de inund...
10	2	400	Niciun pericol i...
11	1	300	Sansa de inund...
12	2	400	Niciun pericol i...
13	1	300	Sansa de inund...
14	2	400	Niciun pericol i...
15	1	300	Sansa de inund...
16	2	400	Niciun pericol i...
17	1	300	Sansa de inund...
18	2	400	Sansa de inund...
19	1	300	Sansa de inund...
20	2	400	Sansa de inund...
21	1	300	Sansa de inund...
22	2	400	Sansa de inund...
23	1	480	Niciun pericol i...

1 of 76 Cell is Read Only.

Figure 3. Sensor measurements recorded in the database

Figure 4. Login application window

6. The automation of systems for defense against natural disasters

This program can be used to automate the flood defense systems in case of flooding and pollution in rivers. These systems can be used for any hidrographic system which has water reservoirs in order to reduce pollution levels or the level of water in case of flooding. The system can control the discharge or intake of considerable quantities of water from the river.

Knowing the storage capacity of reservoirs in real time, the application can decide the regulation of the flow of water from the river through automatic handling of locks. This can be operated by long distance actuators or through its own network. The signals can also be sent through the GSM network.

7. Conclusion

This article presents an application that proposes ideas and solutions for a sustainable development of the knowledge-based society. One can correlate data regarding the annual average rainfall with the amounts of water that flow into rivers or with the influence of environment on water.

- Research possibilities on the measured data are endless;
- Monitoring pollution is also an added value that can be integrated into the system;
- Planning rational water consumption while maintaining its quality parameters is another option that this application can offer.

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