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# INFORMATIC SYSTEM FOR FLOOD PREVENT IN SOMESUL MIC CASCADE

Gicu UNGUREANU, *E-mail: ugicu@personal.ro,* Florin COVACIU, *florinc@email.ro*
Aliodor BALAJ,aliodor@email.ro Alina CALARASU, alina.calarasu@email.ro
Cristian POSTEUCA email:posteuca@personal.ro
*SC IPA SA Cluj Napoca Subsidiary*
*109, Republicii str., 3400 Cluj Napoca, Romania*

## ABSTRACT

In this paper are analized the most important factors for the hydrographic cascade for anticipation the flood phenomenon and to monitoring, operative forecast of hydrographic parametres of the rivers and its tributary.

The paper presents the flood waves atenuation possibilites through effiency usage of a hydropower plant, with contibution of the exploitation units from the Somesul Mic Valley. Reffering data acquired and their processing achieve operative hydrological and metheorological forecast. This achieve defend action coordination of the high flood and contamination risk area because the overflow harmful substances in the valley.

The informatic system achieved the data acquisition of the superior level from the flood anticipation devices (Weather radar) and from the data acquisition station of the cascade. These devices transmit the information referrring to the river lenel, temperature, rainfall and water quality. The system used the determination mathematics models for the flood capacity assuming. In addition, the system simulating and modeling of the abundant precipitation and their contribution to the volume of water, for the forecast hydrometeorological and hydrologic balance generating.

**KEYWORD**: weather radar, hydrometic station, and hydrological balance, pluviometric post

## INTRODUCTION

The paper presents a solution for automatic system and informatic development for the Somesul Mic cascade. The system achieved the automatic data acquisition having an installment pre-establish for the hydrometeorological parameters that influence the cascade water quality.

The Somesul Mic cascade and its tributary has 29 000 $m^2$ area, 500 000 population, placed in 3 villages. In the superior level of the Somesul Mic valley is place the hydropower plant This is develop in 8 steps and afferent lakes, Fantanele lake, with 220 mil. $m^3$ volume, Somesul Cald with 7.47 mil. $m^3$ volume, Tarnita with 74 mil. $m^3$ volume, Gilau with 4 mil. $m^3$ volume, or part of the hydropower plant. In addition, this superior level contains eight secondary collecting placed on Somesul Rece tributary. The up and down stream volume storage, capacity is based on: continuos monitoring of the up and down stream levels, uzinaj flow, overflow through valve. Data are transmitted, processing in real time and storage for correlating the overflow state and to reduce the propagation wave at downstream area.The possibilities to build hydropower station are minim because of geomorfological condition. The higher price for accumulation lake achievement or to build defense breakwater is impediments in monitoring area. The informatic system solve this problems, because it's based on flood phenomenon anticipation techniques and operate monitoring forecasting for hydrologic evolution.

*The System's Architecture*

The hydrometeorologic informational system is structured on the following elements:

- Doppler weather radar placed in the middle of the Somes cascade, so, it can monitor Somesul Cald Valley and Somesul Mare Valley, too.
- An automatic station network placed in Soemsul Mic and its tributary cascade. These communicate the information about hydrometeorological parameters and water quality.
- A automatic station network, placed in upstream of the cascade for lakes lenel measurement, overflows, uzinaj volumes of the hydropower station, the opening of the obstacle, the overflow discharge by the basement emptying and of downstream overflows.
- A working point placed on the dispatcher level. It will have a computer that communicates by radio or GSM with the system assembly.

The architectures of the system are presented in the picture.

***Weather radar***

Today, weather radar can locate and follow precipitation within a range of 200 to 400 kilometres.

Radars provide a way of measuring the intensity of rain and snowfall. Most importantly, radar helps weather forecasters predict and identify, in advance, severe storms that could seriously affect the lives and property.

Weather radar emits microwave energy in short bursts or pulses, which are focused in a narrow conical beam that scans the atmosphere from a slowly rotating antenna. The beam passes through fog and cloud but when it hits rain or snow or ice particles - such as hail - some of the energy is scattered back as an echo to the antenna of the radar. The amount of energy, which the antenna receives, is in proportion to the intensity of the precipitation, the heavier the rain or snow, the more energy is scattered back to the antenna. Since the speed at which the microwaves travel (which is the speed of light) and the direction in which the antenna is pointing are known, the location of precipitation can be calculated knowing the time between pulse transmission and the receipt of echoes. This information is used to map the location and intensity of the precipitation over the area surrounding the radar. The Doppler effect is used in many modern technologies. In addition to determining the location and intensity of precipitation as described above, Doppler weather radars have the added capability of measuring the motion of precipitation. Instead of measuring the speed of one object, Doppler weather radar measures the motion of millions of snow or water droplets in a storm system using microwave energy. The physical characteristics of the wave are

noted when it is transmitted and when it returns after bouncing off the droplets. Through a complex process, the change or shift in frequency of the returned signal is used to determine the motion of the droplets.

The primary mission of the Doppler weather radars is to help protect the life and property from the devastating effects of severe weather. With the new Doppler weather radar network, meteorologists will be able to detect those conditions that could lead to a tornado and to issue a warning up to 15 to 20 minutes before the tornado strikes. This will allow more time for people to take precautions.

Using data from Doppler weather radar, meteorologists will also be able to provide more accurate information more quickly on where a storm will hit and the amount of snow or rain the area is likely to receive. In the event of a storm with heavy rains predicted, this information could be invaluable to organizations such as municipalities and conservation authorities in charge of flood control or the management of combined sewer overflow and storm water run-off in cities and towns.

The weather radars will have a nominal effective range of 240 kilometers in conventional mode and 120km an in Doppler mode. Conventional weather radars are able to detect the intensity and location of precipitation such as rain, snow or freezing rain. Doppler weather radars do this and measure the motion of the precipitation within the storms. Using sophisticated computer techniques, meteorologists can derive other valuable information about the motion of the air currents within the storms.

Meteorologists then search the wind and precipitation patterns for the characteristic signatures of different types of severe weather such as strong winds, down bursts, severe thunderstorms and tornadoes.

With this information and other data from satellites, computer models, weather observations and volunteer observers, the meteorologist issues severe weather warnings. Doppler weather radar provides meteorologists with a powerful tool to help determine the motion and structure within storm systems.

The new network of Doppler weather radars will enable meteorologists to provide better forecasts of significant precipitation events. Areas threatened by heavy rainfalls can be identified more precisely and estimates of the maximum precipitation intensity given more accurately. These improvements can lead to better flood predictions which, in turn, will result in better management of storm sewer runoff, reduced water pollution episodes, and improved warnings to those threatened by floods.

The radiofrequency exposure from Doppler weather radars is well below safety guidelines. Under normal operating conditions with a rotating antenna, the levels are about 50,000 times lower than the safe exposure limit. All the radars operate at C-Band and use co-axial magnetron transmitter tubes. The transmitters are normally tuned to 5625.0 MHz, although the tuneable range is from 5450 MHz to 5825 MHz.

The antennas are parabolic dishes providing a narrow conical beam. The new antennas provide a very narrow nominal beamwidth of 0.65 degrees. The radars operate in a pulse mode with pulse durations of 10, 2 and 0.8 microseconds. The pulse repetition frequencies are from 1200 down to 50 pulses/second, with the higher frequencies being used with the shorter pulses. (The maximum sustained duty cycle for the magnetron is 0.001).

The peak power at the output from the magnetron is 250 kW, so based upon the maximum sustained duty cycle, the maximum average power transmitted is 250 W. The radars operate in a continuous scanning mode wherein they rotate continually in azimuth and step up or down in elevation with each rotation in azimuth. Typically, such a volume scan is completed every 5 minutes. Depending on the elevation angles being used, this means that any point within the volume scan typically only falls within the beam width of the antenna two or three times every five minutes.

*Local Hydrometric Station*

These are placed on the cascade in the interest points, like the main river point, the tributary, and the confluence points. In their component, each automatic station is based on PLC's, that assure the data acquisition, physical parameters primary processing, and storage for a period, dispatcher communication.
PLC's (datalogger) can transmitted with dispatcher computer through radio or GSM modems. PLC"s is placed on the local acquisition point and has the following main technical features:

- Central process unit
- RS 485 communication output
- Program memory: 32 KB
- Data memory : 32KB

The local measurement assembly, sensors and transducers are placed about 500 m from the automatic station. These will be connected to the PLC's analogical inputs. The acquired data are made with a programmed pre-establish through PLC's software that has a fixed acquisition installment. The acquired values are processed and storeged in the PLC's memory, in order to be transmitted at the dispatcher in according with the schedule of computer.
In the measurement point of the hydrometrics station, it will be placed the specific transducers. The maximal configuration is:

- Transducers for lake and river level measurement;
- Transducers for atmospheric measurements
- Transducers for rainfalls measurements
- Transducers for water quality indicator

Level measurements: the level probe is a differential pressure sensor, the level measurement is done by the difference between the air pressure and the pressure exerted by the water column.

The measurement range depends on point where is in use: rivers or accumulation lakes. The range is between 0-1 m and 0-100 m, that they are submersible whit protection IP 68.

The signal provided by the probe is processed, memorized and displayed local or remotely.

From the level measurement in controlled sections of the river, in the staff center computer, on calculate the debit, which will be used to hydro-technical balance shits.

Meteorological measurements: the temperature and relative humidity sensors, rain gauges can achieve a meteorological station.

The meteorological station provides detailed temperature, relative humidity, and rainfall history.

Water quality measurements: water quality sensors are realized in portable sets or analysis kits to establish the water quality and pollution.

*Dispatcher working point:*

In this level, the content of the working point: the computer, IBM compatible, 21" display, plotter, GSM or radio modem to connect the meteorological radar and local stations and points.

*This system performs the following tasks*:

- Data acquisition from the local stations and measurement points
- Local event data loggers
- Modem connection between dispatcher working point and the local levels
- Data base for hydrological data acquisition
- Display under request information from data base
- Display the modification in time of meteorological parameters
- Rapport generation whit the events, display and listing

## CONCLUSION

The development and implementation of the informatic system for Somesul Mic monitoring can't eliminate the damage made by the natural calamities (floods, storms). It creates the possibility for warning in proper time and minimizes the losses and human damages.

The system will assure:

- Increasing the forecast degree for the hydrometeorological events;
- Analyzing in real time for hydrologic parameters
- Increasing the intervention time
- Determination for the risk area in the monitoring cascade
- collaboration with other limitrofe areas for mutual averting

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