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UDC 621.396.218 **RADIOELECTRONICS**

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DESIGN AND MODELING OF AN INFORMATION TRANSFER SYSTEM FOR MANAGING ELECTRONIZED EMERGENCY VEHICLES (EEV)

The designed program model consists of three separate parts which are the input part, the processing part and the output part for registering patients in electronized emergency vehicles and tracking the vehicles to the destination hospitals by low traffic roads with global position navigation systems, as well as for transferring the patient's information via mobile communication networks.

Keywords: EEV, GPRS, GPS, A-GPS, LAB VIEW, ICT, VRP, CUP, HMP.

Introduction. For many years, technology has helped people to improve and secure their lives, but the more the population grows the more the safety and health decrease from the standard quality levels. Traffic also expands day for day which has a direct side effect by generating a delay in emergency service operations, but there are many ways to use the same technologies parallelly to solve part of these problems.

The designed model will use several technologies to help most important operations to save a human's life and decrease the time loss because of traffic, and also control the whole emergency operation from inside the emergency vehicle to the destination hospital. These will help to increase the chances for more patients to survive.

By many technologies people try to overcome different diseases. Those technologies are hospital devices, home electronized devices, computers, cellular phones, data transferring capability, navigation devices, cars, transportation, etc. These help us to have a more comfortable life, but these technologies have some negative side effects on human life, too, like some dangers and time losses. Traffic is one of the biggest problems in this century. Many people lose their time and lives in heavy traffic in big cities around the world.

The main purpose of this paper is to substantiate the application of advanced technologies to help decrease the life loss because of traffic and much paper work in the whole emergency operation. The emergency vehicles help transport the patients to hospitals, and with the electronic medical devices inside, they try to keep the patients alive as long as possible, but if the vehicles spend a very long time in heavy traffic with their elementary devices, they cannot support and save the patient's life because in some emergency cases, patients have to be operated on immediately. The registration of the patient's condition at hospitals is also a loss of time but with this designed model of EEV (electronized emergency vehicle) they can pass through the

traffic and the patient's registration operation by the vehicle, and also the monitoring of the patient's condition in the chosen destination hospital.

Description of the EEV (electronized emergency vehicle) model. The model is designed by Labview to show how we can use the information technology, mobile communication services and the navigation system for emergency vehicles which we call electronized emergency vehicles or EEVs.

The VRP inside the EEV is the first input part of the main system to register the patients and their emergency conditions, VRP enables the emergency vehicle nurses, after picking up the patient, to register the conditions of the patient. This operation will start with the EEV identification number, the patient's name, the family name, age range, sex, condition, vital signs, body part conditions and infusions to monitor all this information at the chosen destination hospital for the emergency unit doctors to know about their patient's emergency conditions before he reaches that hospital.

The destination hospital choice is the main process in the whole system which is managed by the central unit of the designed model. It controlls the EEV via an online map and tracks the position of each vehicle, and manages its destination hospital from the point where it has to pick up the patient, and compares the traffic in the streets and the patient's condition to find the nearest destination hospital which must have the right specialization of treatment for each patient.

The central controlling unit is called CUP or (central unit panel) which follows the online map of the city traffic and tracks the system on the map with GPS trackers for each EEV. This unit calculates and manages the distance between each EEV to the nearest hospital with the required specialization for the patient by the number of EEV which registers its patient from inside the EEV with VRP (vehicle registration panel) at first and sends the information to the central unit to be processed.

The central unit panel, after accepting the EEV's request, automatically brings the identification code of the EEV and the patient's condition, the operator of the system chooses the destination hospital for each accepted vehicle and pushes the button to send the name of the chosen destination hospital to the EEV panel, and at the same time, to send the information on that EEV patient to the chosen destination hospital with the same button on the central unit panel, but if the driver of EEV does not know the exact address of the destination hospital and the routs from their EEV position, the operator finds that out from the map and sends all the exact turns and directions to the EEV panel driver to learn his steps before he reaches the chosen destination hospital.

The destination hospital monitor shows each online vehicle and its patient's emergency condition on HMP (hospital monitoring panel), but for the hospitals, the panel is more expanded than that of the CUP's because it must show more than one emergency condition of the patient for the doctors in destination hospitals. They need to know which part of the body is injured and what is the patient's vital signs, what kind of injections and infusions he has received. Infusion is one of the most important

parts, because any patient inside the emergency vehicle in a good or bad condition, takes some injections to relieve or stay alive until they reach the destination hospital but in some cases the nurses may forget to inform about the injected infusions to the hospital which is very dangerous, but the designed model of EEV's system will decrease that risk for the patient and the nurse because of the developed structure of this model for each part.

The VRP vehicle registration panel. The VRP panel inside the electronized emergency vehicle is for registering the patient after the first pickup inside the EEV, the designed panel starts with EEV identification number or code when the EEV sends its request to the central unit to be accepted and connected to the system.

The second part of the vehicle registration panel is the patient's personal information which starts with the patient's name, family name, age range, sex, the patient's condition and his vital signs. The patient's condition uses the opening cascade menu to choose one of these conditions such as a bone fracture, a dislocated bone, a multiple injury, scald, poisoning, hypotension, wound, heart attack, stroke, apoplexy, childbirth, blood pressure, internal bloodshed, external bloodshed, and internal and external bloodshed.

The vital signs opening the cascade menu are as follows:

1. Vital Signs Normal
2. Vital Signs Shocked
3. Vital Signs Weak
4. No Vital Signs

The VRP is the first part of the operation of this model allowing to register the patient in less than one minute which saves time at hospital because this operation has been done inside the EEV. This way of registration also helps the nurses and doctors not to lose their time for registration and checkup of the patient to understand his emergency situation at entering the destination hospital emergency unit. The next step or the third part of VRP is the body structure injury condition statistics which is very important for the nurses inside the electronized emergency vehicle for their further actions.

The body part structures on VRP are divided into four subparts:

1. Head Parts
2. Vital Organs
3. Digestive Organs
4. Movement Organs

This part helps the nurses inside the EEVs, to jump to the next menu and use the function keys to raise or lower the menus for choosing the parts and opening the menus of each part, then select the condition of each body part and push the tab again to follow and jump to the next body part condition registration, and help save as much time as possible. In this four body part structure group we have four items for each of

them to select the body parts and the conditions of those special parts which are grouped as:

The Head is the first part of the panel for checking the condition of:

- Skull
- Nose
- Jaw
- Eyes

The second part of the Panel is the Vital Organs:

- Brain
- Heart
- Lungs
- Chest

The third part of the body condition panel is Digestive Organs:

- Stomach
- Intestines
- Kidneys
- Liver

The last part of the body condition is about the Movement Organs:

- Spine
- Neck
- Hands
- Feet

Information on the condition of all these parts helps the doctors and nurses to be careful to any movement of the patient or any treatment in the EEV or at the destination hospital.

Each of the menus has three kinds of conditions:

- Normal
- Injured
- Probaly Injured

The operator of the VRP, by selecting each of these items and body structures will send the information on that body part condition to the chosen destination hospital for the emergency unit doctors to know about the patient's body part conditions, and help the EEV team to carry out any movement and electric shock or injection or any kind of relief operation.

The last part of the VRP is about four kinds of injections which are optional to add infusions, or can be empty if the infusions are not necessary for that patient by the type of injections, and select the values of those injections by ml-cc with an opening cascade menu to select and tab the next type of infusion.

All the VRP input fields are generated by a string format by using a cluster to send all this string information as one single data line. With the help of GPRS (general

packet radio services) the system can send all this information from each EEV to the central unit and then from the CUP to the chosen destination hospital.

Wireless telecommunication allowes people to be alive and work in many ways which were impossible before, with over two hundred million cellular subscribers worldwide, users have overwhelmingly embraced the concept of having a telephone that is always with them. And now businesses also have a data connection with the office wherever they go, so that they can have access to e-mail, the Internet, their files, faxes and other data wherever and whenever it is needed, giving them a competitive advantage and more flexible lifestyles. A number of wireless data services are available today, but none are as exciting as a forthcoming data service for GSM networks called General Packet Radio Service (GPRS) [1].

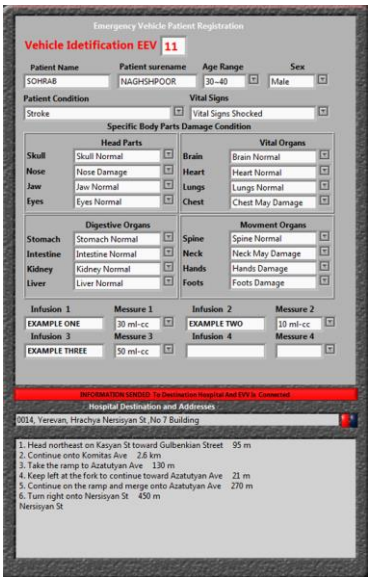

Fig.1. VRP or vehicle registration panel

The General Packet Radio Service GPRS, is a non-voice, value added, high-speed, packet-switching technology, for GSM (Global System for Mobile Communications) networks, It makes sending and receiving small bursts of data, such as e-mail and web browsing, as well as large volumes of data over a mobile telephone network possible. A simple way to understand packet switching is to relate it to a jigsaw puzzle. Imagine, you buy a complete image or picture that has been divided into many pieces and then placed in a box. You purchase the puzzle and reassemble it to form the original image. Before the information is sent, it is split up into separate packets and it is then reassembled at the receiver's end [2].

GPRS offers a continuous connection to the Internet for mobile phone and computer users. Experience has shown that most data communication applications do

not require continuous data transfer, Users may need to be connected to a data communication network (such as a LAN, WAN, the Internet, or a corporate Intranet), but that does not mean they are sending and receiving data at all times [3]. Data transfer needs are not generally balanced. In the majority of cases, users will tend to send out small messages but receive large downloads. GPRS is expected to provide a significant boost to mobile data usage and usefulness [4]. It is expected to greatly alter and improve the end-user experience of mobile data computing, by making it possible and cost-effective to remain constantly connected, as well as to send and receive data at much higher speed to help the EEVs for sending and receiving information to the central unit and the destination hospitals, its main innovation is that it is packet - based, all information on the patient is sent as a data packet to the central unit to be processed with in a string format and low volumes so that it will increase the data transmission speed and keep the EEV online steady.

The EEV tracking system. The tracking system for EEV is one of the most important parts of the designed model to decrease the time loss over the EEV's way and help it to pass the traffic to save the patient's life as much as possible, the GPS or global position system is a satellite technology to help any GPS device on earth to find its global position by X and Y then the altitude by Z.

Signals are transmitted from each satellite in the direction of the Earth. This signal is encoded with the "Navigation Message," which can be read by the user's GPS receivers. The Navigation Message includes orbit parameters (often called the "broadcast ephemeris"), from which the receiver can compute satellite coordinates (X, Y, Z). These are Cartesian coordinates in a geocentric system, with the Z axis pointing towards the North Pole, X pointing towards the Prime Meridian (which crosses Greenwich), and Y at right angles to X and Z to form a right-handed orthogonal coordinate system [5].

The time during which the signal is transmitted from the satellite is encoded on the signal, using the time according to an atomic clock onboard the satellite. The time of the signal reception is recorded by the receiver using an atomic clock [6]. A receiver measures the difference of these times, Fig.2.

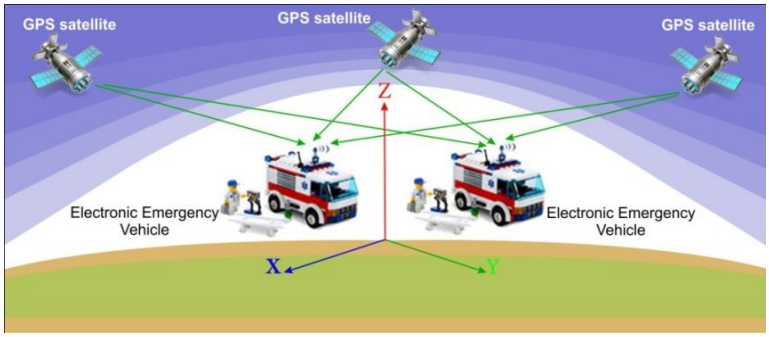

Fig.2. Global position system satellite connectivity with the EEV

The blind spots like tunnels or high buildings are usual problems for GPS devices as they cut the signal from satellites to the GPS receiver devices but the tracking of EEV's are very important to the central unit to manage all electronized emergency vehicles on the map and give the best roads to the nearest destination hospital with the needed specialization for their patient's treatment.

This problem is solved by A-GPS (assisted global position services) to help find the electronized emergency vehicles' position under the GPS blind spots, like under tunnels, and between high buildings or at strongly cloudy weather conditions, the A-GPS working via mobile communication antenna signals from cellular towers which are used to send and receive the information on the patient with the GPRS technology.

At the GPS blind spots, the A-GPS automatically starts to work and calculate the distance between the electronized emergency vehicles and the cellular towers of mobile signals to find the position of the EEV at the blind spots of the satellite, for example inside the tunnels, GPS signals will be lost and the GPS device disconnects from the tracking services, but the cellular signals support all the area inside the tunnels to keep the tunnels under the coverage of mobile services. With those technologies, the central unit can follow the vehicles everywhere with the help of GPS, or at blind spots of GPS, with the help of cellular towers and the A-GPS system.

The CUP Central Unit Panel. The central unit panel is a very important unit for this model working around the whole emergency system to manage the EEVs. The vehicles are under tracking on the map all the time when they are at work, the central unit monitors the position of EEVs and knows the address of each hospital and its specialization of treatment for the patient.

After the pickup of the patient, the EEV registers the conditions of the patient and his body part conditions by the designed model program but the important part of the central unit operation is to control the patient's emergency condition after the pickup and after receiving the request by the EEV to be input in the CUP of the designed model.

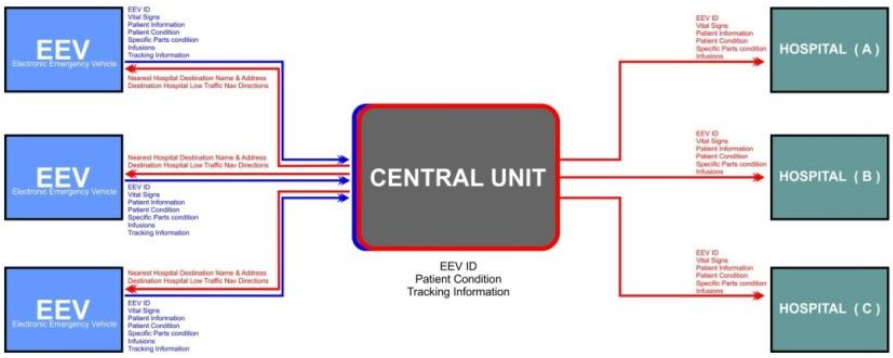

Fig.3. Algorithm of EEV's operations with central unit and hospitals

The central unit notification alarm lights and the operator of the system understands that one of the EEVs wants to be connected to the center by sending the request, the operator of the CUP pushes the acceptatance button to let the vehicle enter the central unit panel.

The first thing that shows the CUP is the EEV identification, which is registered on the VRP inside the electronized emergency vehicle and the second part is just about the patient's emergency condition, the central unit finds the vehicle on the online map and follows the city street to find a low traffic route to manage that EEV's passage to the chosen destination hospital. The operator finds the nearest hospital with a specialized treatment for the patient along the ways with possibly low traffic after processing all these things and choosing the nearest hospital from the list, it sends the brief information on the hospital and roads with all turns and directions to the EEV driver to follow the path and pass along the streets and reach the hospital as soon as possible.

At the same time, by choosing the nearest hospital from the list and pushing the button to send the hospital name to the EEV, the central unit makes connections between the EEV and the destination hospital by sending the EEV's identification and all the registered information on the patient to the chosen destination hospital HMP.

This online connection between the EEV and the destination hospital helps the nurses inside the EEV to connect with the destination hospital emergency unit doctors to do everything right, and the doctors in the hospital emergency unit to know all information on the patient in the EEV and get ready to accept the patient and treat him in a specialized way.

When the EEV arrives at the destination hospital emergency unit, the doctors know about the conditions, vital signs and injections carried out inside the EVV and it helps to decrease the confusion of doses, etc.

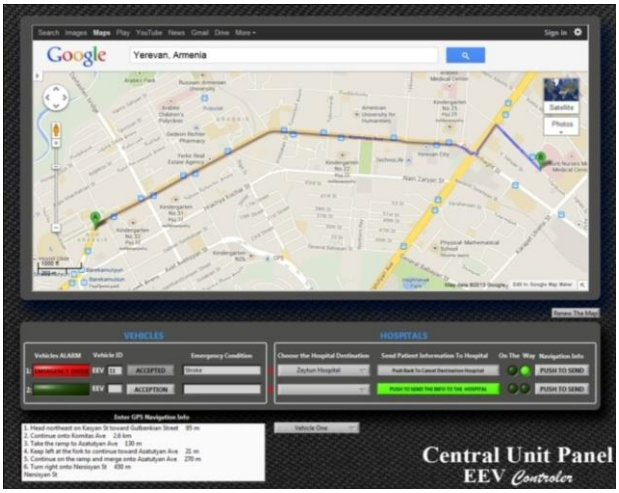

Fig.4. CUP or central unit panel

The HMP Hospital Monitoring Panel. The hospital monitoring panel shows all the information on the patient's name, family name, age range, sex, patient condition, and vital signs of the patient and all the body part injuries, or normal or probable injuries.

That information is registered from the EEV by the VRP of this model which is done by the nurses inside the EEV and sent to the central unit to take a permission from the central unit and show the chosen destination hospital on the monitor panels which are chosen by the central unit operators to transfer to the doctors at the destination hospital.

Fig.5. HMP (hospital monitoring panel) view

After the EEV arrives at the destination hospital, the monitored information can be saved by the operator or used by the barcode scanner technology for each EEV, when the EEV arrives at the destination hospital emergency unit entrance, the barcode reader scanner automatically reads the barcode of that vehicle and sends the received information from the CUP to the servers for the patient's online documents to the doctors, hospitals and patients, and allows to get the medical information about their treatment histories. The information will be accessible online all the time.

Conclusions. The designed model, by using developed technologies like the mobile communication technology, the information technology and the navigation system will help to develop the emergency vehicles, all the emergency operations generating communication between the emergency vehicles and the center and the hospitals with the help of mobile network communication. The patient's registration operations will be carried out inside the emergency vehicles completely, and when the patients arrives at the destination hospital, he will not lose his vital time for the registration operation and checkup, because that information has been received before

his arrival. The same is with the whole information, vital signs and the condition concerning the patient.

This model will help to track the emergency vehicles with the GPS service to control each EEV in every state and street of the city, this can also help the system operators in the central unit to find the best and shortest roads for each EEV on the map by keeping them far from the heavy traffic zones. This model can solve a huge percentage of emergency vehicle problems related to delays because of traffic and, increase the chance of saving the patient's life. It can also help the doctors and nurses in the destination hospital to get ready for a specialized treatment of the patient.

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Ս.Շ. ՆԱՂՇՊՈՒՐ

ՇՏԱՊՈՀԱԿՆՈՒԹՅԱՆ ԷԼԵԿՏՐՈՆԱՑՎԱԾ ՄԵՔԵՆԱՆԵՐԻՑ ՏՎՅԱԼՆԵՐԻ ՀԱՂՈՐԴՄԱՆ ԿԱՌԱՎԱՐՄԱՆ ՀԱՄԱԿԱՐԳԻ ՆԱԽԱԳԾՈՒՄ ԵՎ ՄՈԴԵԼԱՎՈՐՈՒՄ

Մշակված է շտապօգնության էլեկտրոնացված մեքենաների LabView միջավայրում աշխատող մոդելը՝ բաղկացած երեք հիմնական մասերից՝ տվյալների ներմուծում, տվյալների մշակում և հիվանդի գրանցում: Նախատեսված է նաև դրանց ուղղորդումը ճանապարհային խցանումները շրջանցելու պայմանով, օգտագործելով անլար շարժական հեռահաղորդակցության և GPS տեխնոլոգիաները:

Առանցքային բառեր. շտապօգնության էլեկտրոնացված մեքենաներ, GPRS, GPS, A-GPS, LabView, ICT, VRP, CUP, HMP:

С.Ш. НАХШПУР

ПРОЕКТИРОВАНИЕ И МОДЕЛИРОВАНИЕ СИСТЕМЫ УПРАВЛЕНИЯ ПЕРЕДАЧЕЙ ДАННЫХ ИЗ ЭЛЕКТРОНИФИЦИРОВАННЫХ МАШИН СКОРОЙ ПОМОЩИ

Модель, разработанная в среде LabView, состоит из трех основных частей: ввод данных, обработка данных и регистрация пациента, перемещаемого в электронифицированной машине скорой помощи. Предусматривается также учет дорожного трафика посредством применения технологий беспроводной мобильной связи и GPS.

Ключевые слова: электронифицированные машины скорой помощи, GPRS, GPS, A-GPS, LabView, ICT, VRP, CUP, HMP.