Ryszard Hycner*, Jan Ruchel*

Free Software Applied in Surveying Computations**

1. Introduction

The main aim of this paper is presentation possibility and accessibility of software, especially free software to run surveying computations.

Free software is a term describing software which can be run, copied, distributed, analysed, changed and improved by users [13]. In order to call software "free", it must fulfil some fundamental assumptions, which have been contained in free software definition, published by Free Software Foundation.

It means that the program's users have the four essential freedoms [13]:
– The freedom to run the program, for any purpose (freedom 0).
– The freedom to study how the program works and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
– The freedom to redistribute copies so you can help your neighbour (freedom 2).
– The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

Freedoms 1 and 3 can be fulfilled only when one has access to the source code of the program. Free software does not need any licensed payments for its application.

Open source movement – is a fraction of free software movement which proposes the name: open source software as an alternative to free software, for practical reasons. Apart from free distribution it can be sold and used in commercial way.

 * AGH University of Science and Technology, Faculty of Mining Surveying and Environmental Engineering, Department of Geomatics, Krakow, Poland

Reaching profits one can also limit for sale of additional services such as: operation training, client supporting or access to additional extensions, plugs-in, accessories and modules. It is also possible using free of charge open source version as a method of stimulation for buying more developed version, offered as commercial licence. Open source software can be also used as a way of introducing client to other, payable products of firm. The following possibility is free of charge delivering only source code, whereas executive libraries are delivered for payment.

There is clear disaccord between free software and open source philosophies [13]. Free software emphasises on moral and ethics side of accessibility of software while open source stresses technical perfection of code. Practically, each programme of free software is also open source, but not any programme of open source type is simultaneously free software as well. Taking into account existing differences between approaching of both movements, they are called by FLOSS (Free/Libre Open Source Software).

Free software is a philosophy of programmes creating, which is strong developed and promoted nowadays in many human circles. Thanks to efforts of lot of enthusiasts many such programmes are being developed. Their usefulness is sufficient for applying them instead of commercial, extremely expensive technical programmes, sometimes.

2. Types of Software Licenses

Licence for software is an agreement between editor of programme (person to whom belongs copy right) and a person who intends to use this programme. Licence contract touches us mostly, while programme installation when we are asked to confirm that we know conditions of licence and accept them. We must also often declare that conditions of licence will not be broken. Law regulations, controlling this problem in Poland are based upon Act – about copy right and similar rights. Copy right is regulated by Act from 1994 [12]. Computer users can meet mostly with so called user's licence EULA (End User License Agreement), which is used by software producers to tie users by additional limits.

Licenses for software are usually very restricted. Unfortunately mostly of users do not read them on the whole. Standard element of almost each license is clause about excluded responsibility of producer by reason of applying software by user. It means that software producers have not any responsibility for, among others, consequences of errors made in programmes. Licenses belonging to FLOSS are reactions for restrictions of licenses of commercial software.

2.1. Commercial Licenses

Commercial **licenses** need suitable expenses born by user of programme. There are many types of commercial licenses. They are shown below.

Retail software "BOX" – also called Full Package Product, is accessible in shops, dealers or in the other producer's representatives. Such software contains license for product, original package, manual instruction or installation and medium with programme. There are various versions of license, making purchase many versions of programme for one user possible. It enables to reduce price of single installation.

Concurrent software "OEM" (Original Equipment Manufacturer) – a software which is accessible exclusively with added hardware. The right for using OEM programme includes only and exclusively hardware which has been bought together with programme. It is a "salvo" used by producers very often, for temporary prices reductions. For example, operation system of a particular producer in laptop is offered for 1/20 of nominal price.

Shareware software – needs payment after passing some tentative period of time, when user can test quality and usefulness of programme. It often results limited number of executions of programme. Obligation for payment is not forced by produces sometimes, and left for user only as moral problem.

There are many versions of shareware type. The most often shareware software are:

– adware – user agrees for inserting advertisement information, instead of payment;
– postcardware – author of programme asks for thanks in shape of postal card;
– charityware – using programme needs payment for the benefit of indicated charity institution;
– nagware – projects report, reminding user of payment obligation;
– donationware – programme can be used only when payment has been done; yet amount of payment depends only of user.

One should also mention educational versions of programmes. They give possibility of applying programmes exclusively in educational processes by universities, colleges, schools, teachers and students. Programme of this type can't be used for commercial purposes. The price of educational version of programme is generally about 20% of commercial price, or up to 50%. Yet, as a result of hard competition on free software market, it is visible more often, that producers render computer programmes accessible completely free of charge or only for token payment. It concerns generally former version of programme.

2.2. Cost-Free Licenses

Besides payable licenses for programmes, one can also show free of charge licenses. There are some of them, below.

Freeware software – programmes can be used and distributed without payments, yet one can't modify their source code. It is permitted application of programme for private purposes, sometimes, but its distribution is forbidden.

Trialware software – after installation programme is fully efficient and all its components run, but through determined period of time from the day of its installation (average from 30–60 days) or through determined number of executions.

Demo versions – after installation the programme itself has not any time restrictions, but some of its functions is not active; this feature diminishes its value for user, although gives general view for its possibilities.

General Public License GNU – is one of free software licenses. The aim of this license is to transfer rights for users to run the programme for any purpose (freedom 0), to study how the program works, and to change it in order to adapt it according to user's wishes (freedom (freedom 1), to copy it (freedom 2), to distribute programme copies and to modify source version of programme (freedom 3).

Public domain license – generality of texts, photos, music, objects of arts, software, and so on, which as a result of author's decision, lack of heirs or passing suitable period of time become accessible for any purposes without restrictions coming from copy right. Each work belonging to this license can be used in any way.

Abandonware software – programmes which are not supported and assisted by author; it is also possible that author consciously abandoned copy rights. In this manner, one make programmes from eighties of last century, generally accessible.

3. Computation Programmes in Surveying Environment

There are many programmes serving for surveying computations. They are of various types. They are both commercial and non commercial. A short review of existing, most often applied surveying computational programmes is shown below. These programmes are used by surveying enterprises, at surveying faculties of higher schools and by individual surveyors.

3.1. Commercial Versions

There are some, commercial versions, the most popular programmes, used in surveying computations very often.

The most popular programmes are shown below.

C-GEO [1] – this program, adapted to Polish reality, enables to perform majority of surveying tasks. So, it enables changing data with almost all electronic field book and instruments accessible on Polish market. The most important modules are: traverses, sections (also with adjustment), crossing lines, offsets, computation and adjustment parcels areas, afine and Helmert transformation, tacheometry, computation of bench marks leveling, horizontal and vertical networks adjustment (each to 200 points), computation of volumes and contour lines, projecting roads.

GEO 2000 [2] – package of surveying computations dedicated for scientific calculators. It enables following computations: angles, distances, azimuths, polar data, orthogonal data, polar method, offsets, sections, traverses, coordinates transformation, crossing lines, areas, and eccentric measurements. Database, integrated with programme, enables writing down coordinates in calculator memory and use them during computation.

GEONET [5] – package of several dozen programmes, performing useful computational surveying tasks. They comprise: surveying networks of any classes, including networks measured by GPS method, detailed surveys, digital topography, coordinate systems, transformations, engineering and mining surveying tasks, analyses of horizontal and vertical displacements. There is also: adjustment of any type networks, particularly special networks, such as mine, setting out, and for measuring displacements. One can also mention: automatic computation of approximate coordinates, capturing data from electronic field book or from text files, verifying accuracy of adjustment results through Gauss-Newton iteration procedure, full analysis of accuracy results and graphic interpretation results. Package also contains its own input files editor and graphic editor.

WinKalk [14] – it contains about 30 computational functions of various types. They are typical as: computing tacheometry, offsets, sections, areas, setting out data and more complex as: traverse, free station, laying out parcels and so on. Additional modules contain packages for projecting of routes and elevations surveys. Graphic module, built-in the programme enables displaying and edition of computed surveying constructions. Module of cooperation with electronic field books enables data transmission directly from recorder or from tacheometer. There is also additional, payable module, serving for rigorous adjustment of set of traverses, horizontal networks and sections. This modules has many interesting possibilities, like: automatic computation of approximate coordinates, finding out blunders, and so on.

3.2. Computational Modules

They are as separated parts or as built-in element of complex information systems. There are also many of such modules.

The most popular modules are shown below.

GEOSECMA [8] – is a system of GIS type, dedicated for planning, managing and registering infrastructure data. The application package Surveying can be used for making detailed maps and real estate maps (of legal character), for projecting roads and railways and setting out processes. Package contains applications for managing of data, captured from electronic field books and sent to them, for registration and verification objects in database, for adjustment of horizontal and vertical networks and also for managing data coming from GPS surveys.

GEO-INFO [4] – is an object of Spatial Information System for managing large scale map and topographic map in digital form in Poland. GEO-INFO DELTA version contains computational implemented procedures, which enable to prepare fully digital surveying work, using field data and data taken from surveying documentation centre. More important procedures are: computation of any section together with adjustment, rigorous adjustment of any points of horizontal network, transformation of single points or set of points belonging to database. GEO-INFO MAPA version contains additionally computational-designing module, which enables computations and designing geometry of objects and computations of data to set out object by polar and orthogonal methods.

GEO-PLUS [7] – is a separated module of surveying computations, from GEO-MAP system (which is a Land Information System, that is a tool for creating, updating and analysing data, making data accessible and using them for various purposes). It contains: editor of coordinates enables to import and export coordinates files, collecting data from various data field recorders, automatic computation of approximate coordinates of points networks. Moreover it enables rigorous adjustment of networks, containing up to 400 unknowns, with the possibility to throw out condition about faultlessness of control points and finding out blunders of observations, computations of detail coordinates, computations of setting out data by polar and orthogonal method, computations of areas of parcels, real estate subdivisions, Helmert transformation.

3.3. Non Commercial Versions

Non commercial versions of surveying computational programmes are used by surveyors occasionally. There are also a big amount of these programmes. The most popular ones are shown below.

GeoPoint 2011 [6] – is a free of charge programme, which after installation needs code of authorization, delivered by producer. It is an application enabling more effective work based on field data directly in AutoCAD environment. It enables to perform essential surveying computations such as: tacheometry, leveling, polar and orthogonal data, setting out, sections. Application also assures prepar-

ing reports of computation results and managing of computed out points. Module of computation contains the most fundamental computational forms, creates reports of computations in MS Word programme and has an option to read in tacheometry field data, written down in a suitable format. Module of managing of points enables to modify, add and erase points, and also assure consistency and clarity of data.

Surveying calculator [10] – is a programme which enables to perform essential surveying computations. Calculator is easy to use. It enables: computation of location of single point by offset, crossing lines or section, computation of angle or azimuth and transformation by two control points.

GeodeTKa [3] – is a programme suited to essential surveying computations. It is dedicated for Linux operation system although it is accessible its version dedicated to Windows system. Unfortunately, the last version from 2007 it has been not developed, so far. The program, based upon related database SQL enables to collect points and observations. It is also possible import and export data by text files. Computations involve: sections, offsets, crosses, points transformation, areas and traverse. One should mention that the reason that some words have been devoted to this programme is a fact, that it is only one surveying application public accessible to Linux platform. Program itself is simply weak and ineffective.

4. Conclusions

Presented review shows, how various programmes, both from the point of view of manner of granting licences and the range of accessible computational procedures, function in surveyor's environment. One should also mention, that surveyors, especially in small enterprises, often use individual software, that is programmes created by staff of this firm or by "friendly" or cooperating persons or teams. Such software usually is not generally accessible, or its commercialisation has been failed for various reasons. Such program was created still for DOS environment very often or newer has been already created for Windows platform. Most often they are programmes for adjustment surveying networks. Programs for DOS environment are different versions of Fortran language (mostly) and Pascal or Basic. Programmes for Windows environment are different versions Visual Basic or Delphi. Equally often are used dedicated programmes, created within generally accessible applications, mostly by VBA (acronyme for: Visual Basic for Applications) through Excel or Access programmes. Each of these created programmes has limited circle of users [9].

Frequency of applications programs presented above, depends in high degree from the size and specialty surveying enterprises. It is also essential location of the

enterprise. But it seems, that the most important factor, deciding about universality of programme is its price. Yet, one should remember the rule (applied not only in computer science field) that product which has to have very broad application and has to be the cheapest, probably has low usefulness for users and can be questioned.

Non commercial, commonly accessible programmes, almost don't exist and these which are on the market have limited possibilities. Usually they are single product, being often results of students diploma projects, not longer developed by authors. Usually they are not entirely free of charge, since they force using the other, commercial payable software or hardware of a definite firm. One can generally say, that there is lack of significant non commercial programme, serving for surveying computations in Poland, belonging to free and open software.

Thus, one can assume, that good, friendly in use and possible versatile but comprises fundamental range of surveying computation programme, would win many users. One should have a hope, that such programme will appear an will be developed and fitted to actual conditions in surveying and informatics environment (mainly platform systems), by its author.

Conditions which such programme should fulfil are:
– multi-platforms (Windows and Linux, Android),
– friendly interface enables to avoid service errors of programme itself and also to assist to find out errors data,
– not very restrict technical demands, or suitable version LIGHT which enables also its installation in notebooks and tablets,
– export and import (to programmes and equipment) surveying data,
– suitable range of computations, comprising fundamental computations and adjustment of networks of medium size,
– simplicity of installation and service,
– optionally to have module to database management (points, observations)
– making source code accessible in order to fit programme to individual user needs and permit to develop the programme by broad circle of users.

Such programme would permit on friendly and free of charge typical surveying computations in majority surveying enterprises, leaving non typical, hard computations and adjustment of big size networks by commercial, specialty programmes.

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