

AUTOMATED WORKPLACE FOR THE DEVELOPMENT OF ELECTRONIC COMPONENTS

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Abstract:

This paper is devoted to the study of the possibilities of building an automated workplace to control the processes of development of electronic products. The duration of software development here is estimated. Given the schedule of implementation the main 6 objectives on the basis of the graphical representation of the Gantt chart. First, the subject area is analyzed. Then the analysis of the requirements for the automatic workplace of the test engineer is carried out. The software requirements are then reviewed. The user interface is being developed. The software is being tested and deployed. An explanatory note is issued. The test plan is given in the form of a table. It describes the forms of functional test workstation for test engineer. Given: the user registration form, login window, main window, a list of users, the form with the editing user information window, a camera list window to add, change, and show the list of controlled camera parameters, the window with the controlled parameters, a window to create a new window parameters, showing the start of the test. We show how the software is deployed.

Keywords:

Automatic workplace, design, experiment, engineer.

ACM Computing Classification System:

Communication hardware, interfaces and storage, electronic design automation, hardware validation, hardware test.

Introduction

Very important requirements of electronic products are the quality and reliability, regardless in what electronic equipment they will be used as parts: set of missile control systems, aviation facilities, nuclear power plants or in televisions and washing machines. Therefore, in solving the problem of ensuring the quality of electronic equipment, a significant role belongs to the testing of electronic equipment products [1], allowing to establish compliance of products with the required parameters and to identify technological shortcomings [2].

Climate tests are among the most important types of tests. Under them are usually involved tests of resistance to the effects of high (or low temperatures), resistance to humidity test (moisture resistance) or resistance to low atmospheric pressure.

Tests are carried out to determine the ability of products to maintain their appearance and the value of the parameters within the established norms.

Climatic chambers and pressure chambers are used for climatic tests. The test sample is placed in a closed volume, the temperature of which varies according to the specified program for several cycles. Typically, one cycle involves heating to a certain temperature at a given rate, at the end of which the temperature is kept constant for some time.

This is followed by a cooling period with a predetermined speed to a certain temperature at which the material again withstands a predetermined time, as well as a change in humidity and pressure can be added [3].

Naturally, to ensure the accuracy of the specified test program and the repeatability of the test results, the quality of the equipment used must correspond to a sufficiently high level.

Tests should be organized in such a way as to ensure the reliability and continuity of the chambers, strictly observe the test parameters, ensure accurate recording of measurement results and reproduction of test data, and minimize the possibility of subjective intervention of the test engineer [4].

This paper discusses the possibility of building an automated workplace to control the development of electronic products.

1 Estimation of Software Development Duration

Gantt chart is one of the representations of the tasks given for final qualifying work. It is a graphic representation of the planned problem solving script, a convenient tool for solving problems in software implementation [5, 6].

A chart is a schedule of individual tasks, in which each task is depicted as an icon whose length is proportional to the duration of the tasks, and there are connections between tasks - the arrows, linking these icons. (Fig.1) shows the schedule for the implementation of 6 main problems.

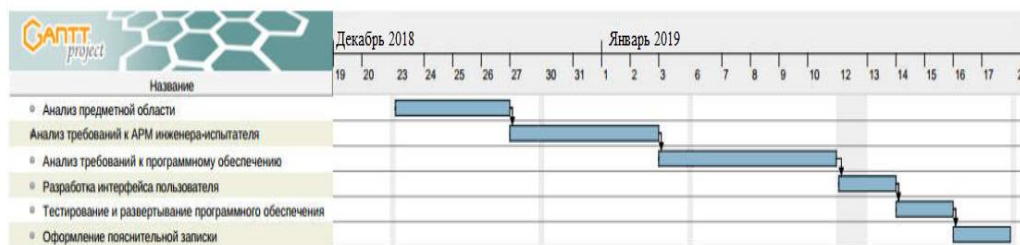


Fig.1. Gantt chart: December 2018 January 2019, six steps: three steps of analysis, test preparation, test and report writing.

The first task is the analysis of the subject area, the execution of which is to study the specifics of conducting electronic products at the testing center. According to the diagram, we can see that the deadline is 27.12.2019.

The second task is the analysis of the requirements for the automated workplace of the test engineer, which consists in acquainting and examining the normative and technical documentation governing the requirements for conducting the test. Deadline 03.1.2019.

The third task is to analyze software requirements. At this stage, a study of software standard test chambers is done until 11.01.2019.

The fourth task is a development of the user interface. At this stage, a special focus is given to the interface part of software that is visible to the user and designed to provide convenient data display, control or dialogue. Deadline 14.1.2019.

The fifth task is the testing and software deploying. Deadline 16.1.2019.

The sixth task - the design of the explanatory note. Deadline 20.01.2019.

2 Software Testing

The quality of a software product is characterized by a set of its properties that determine it from the point of interest of concerned parties.

Each of the participants may have a different view of the product, and how high the quality of the product is. Thus, the formulation of the task of ensuring the quality of a product is translated into the task of identifying stakeholders, their quality criteria and then finding the optimal solution that satisfies these criteria.

Testing is one of the most well-established ways to ensure the quality of software development [13].

The test plan is presented in (Tab.1).

Table 1. Test plan.

Test name	Actions	Expected result	Received by result
Launch applications	User launches the application first time after installation	A message appears stating what is necessary to create admin management after which an eye of registration admin will appear	Expected results comply
Launch applications	User runs the application with an existing database of users	A window will appear: authorization	Expected results match
User authorization	User introduces correct login and password	The main thing will appear in program window	Expected results comply
User authorization	User enters wrong login or password	A message about authorization error appears	Expected results comply
Open list of users	In the main window: administrator presses menu "System" → "List users ... "	A window will open with list of all registered users	Expected results comply
To add user	In the list box of users the administrator presses "Users" → "Add user ... " and enters the new user data, and presses save	In the list of users a new user will appear	Expected results comply
Edit user	In the list of users administrator clicks right click on user and in context menu clicks "Edit ..."	A window will appear for editing user data	Expected results comply
Delete user	In the list box of users the administrator clicks right click on to the user and in context menu presses "Delete"	Selected user will be removed from list	Expected results comply
Open list of cameras	In the main window, the administrator presses the "System menu" → "Camera list ..."	A window will open with list of all cameras	Expected results comply
Add camera	In the camera list window the administrator clicks "Cameras" → "Add the camera ... ",	A window will appear to add new cameras	Expected results comply
Edit the camera	In the camera list window the administrator clicks with the right mouse button on camera and in the context menu presses "Change ..."	A window will appear to edit a camera data	Expected results comply

Table 1. Continued.

Test name	Actions	Expected result	Received by result
Remove camera	In the camera list window administrator clicks right click on the camera and in context menu presses "Delete"	Selected camera will be removed from the list	Expected results comply
Open list of controlled parameters	In the camera list window administrator double clicks on the camera	A window will open with a list of controlled camera parameters	Expected results comply
To add controlled parameter	In the list box of controlled settings the administrator clicks "Parameters" → "Add"	A window will open add controlled parameter	Expected results comply
Create controlled parameter	In the window to add controlled parameter user presses a button	A window will open create new controlled parameter	Expected results comply
Delete controlled parameter	In the list box of controlled administrator settings a right-click on the camera, and in context menu to press "Delete"	Selected controlled parameter will be removed from the list	Expected results comply
Launch the test	In main window the user presses item "Tests menu" → "Launch test...". In next window then selects the camera and necessary parameters, then sets duration, presses run and in next window introduces limits of control parameters	Window pane launch tests then task window limits controlled parameters	Expected results comply
View progress trials	In the main window the user double clicks on selected test item	A window appears with test progress	Expected results comply

3 Description of the Forms of Functional Testing of the Automated Workplace of a Test Engineer

(Fig.2) shows the form “Message about the absence of an administrator in the system”, the appearance of this form indicates that the administrator account has not yet been created, and you need to register yourself to start working with the system.



Fig.2. Message about the absence of the administrator in the system.

The user registration form is shown in (Fig.3). To work in the system, you must specify the type of user, enter your username and password. To complete the registration specify your name and click "Save".

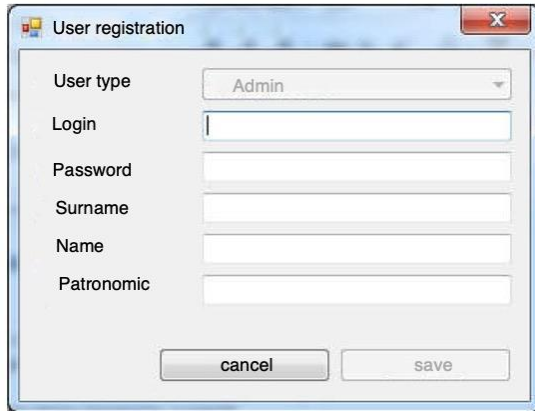


Fig.3. Admin registration.

The authorization window is shown in (Fig.4). For a successful authorization, you must enter the login and password specified during registration and click the "Login" button.

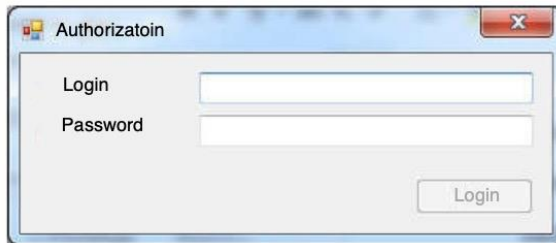


Fig.4. User authorization.

After authorization of the user, the main window of the program (Fig.5) opens in which the user's full name is entered after the "Testing station" field. In the window you can see the full name of the operator, camera type, test status ("running", "not running") and the duration of the test.

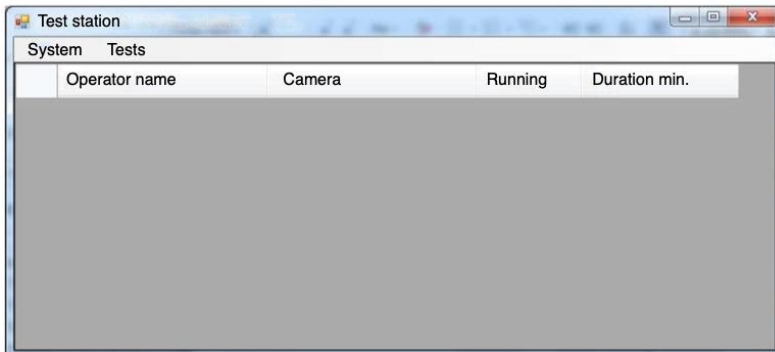


Fig.5. The main program window.

We return to the authorization in case where the username and password were entered incorrectly, the “Login or password did not match” window (Fig.6) appears, the authorization error does not allow you to login, so you should try entering different password or username, or in extreme cases to restore the password.



Fig.6. Authorization error.

The form “List of users” allows you to control all users in the system. It contains the user's full name, username and password, as well as the position in which he is located (Fig.7).

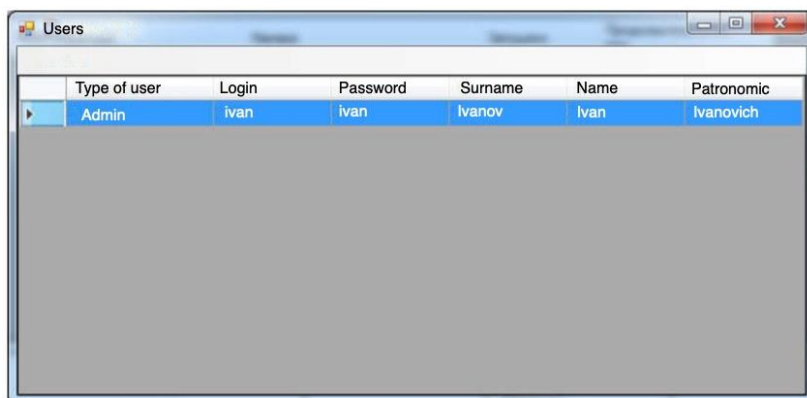


Fig.7. User list.

The form “Editing user data” (Fig. 8) was created for quick data correction, in which you can change your username or password, name, and type of user, most often this is necessary when promoted, changing your name or for security reasons (periodic password changes reduce the risk of user hacking).

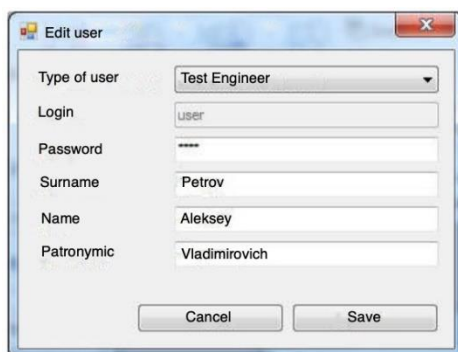


Fig.8. Editing user data.

The next window “List of cameras” (Fig.9) allows you to take into account the number of cameras available in the system.

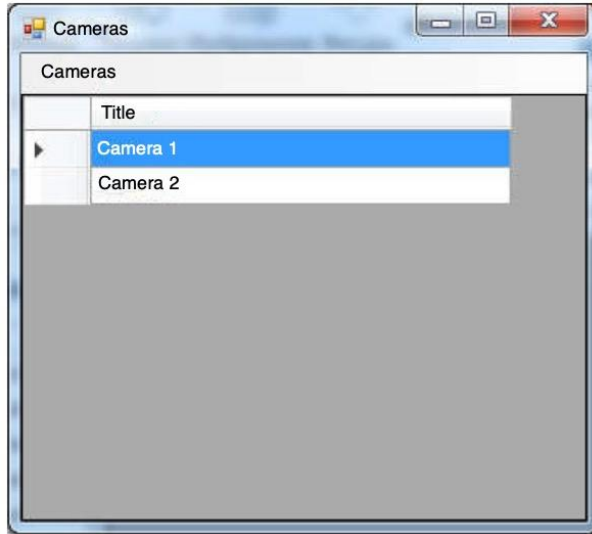


Fig.9. Camera list.

(Fig.10) shows the “Add camera” form, and to add a new camera, you need to enter the name of the camera in the “Name” field and click the “Save” button.



Fig.10. Add camera.

To correct the camera name, there is a “Change camera” window; to do this, in the “Name” field, you must enter the desired camera name, then click the “Save” button (Fig.11).



Fig.11. Change Camera.

For each camera there is a separate window with its “Controlled Parameters”, where you can see and analyze the capabilities of each of the existing cameras (Fig.12).

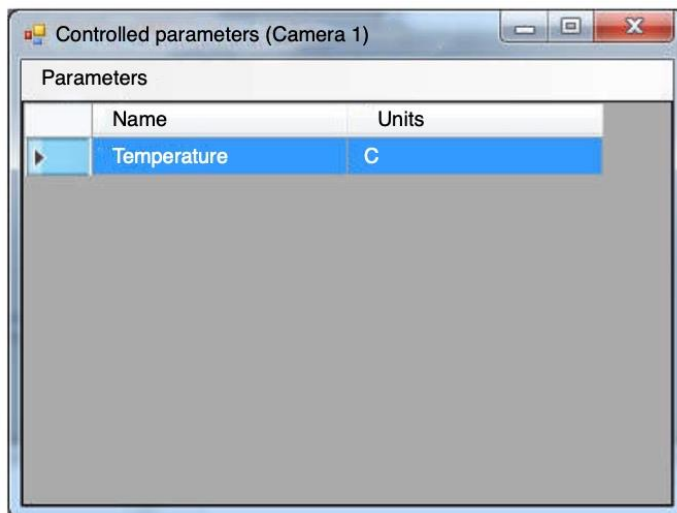


Fig.12. List of monitored camera parameters.

In the “Add Controlled Parameter” window, you can select already existing parameters and click the Add button, or add a new parameter (Fig.13).

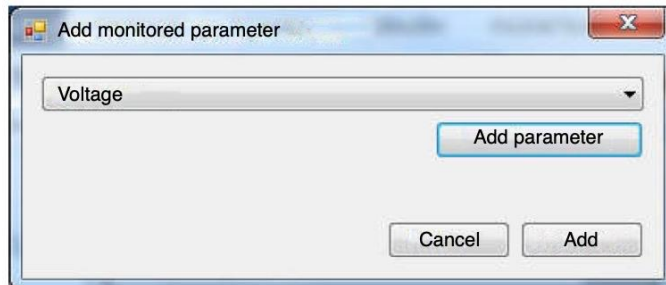


Fig.13. Add controlled parameter.

After “Creating a new parameter” has been selected, the “New parameter” window appears where you can specify the name of the parameter and the unit of measurement, then click the “Add” button, after which the created parameter will be among the monitored ones (Fig.14).



Fig.14. Creating a controlled parameter.

Next, go to the test itself: a “Run test” window was created (Fig.15), where you can select the desired camera, temperature, voltage or resistance, as well as the duration of the test in minutes. To start press the “Start” button.

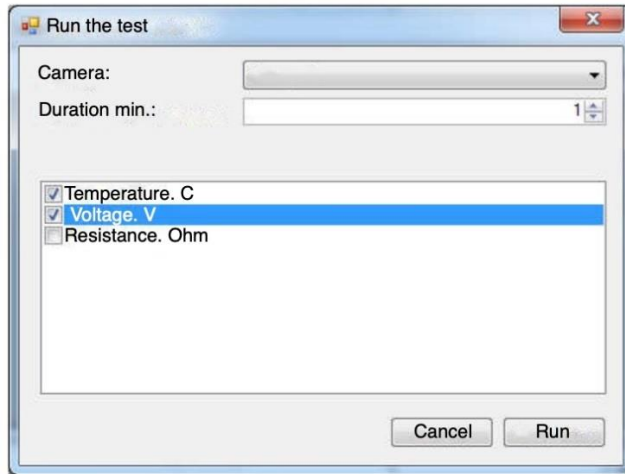


Fig.15. Running the test.

In the “Voltage” window, you can specify the necessary control limits in two fields “min” and “max” (Fig.16) .

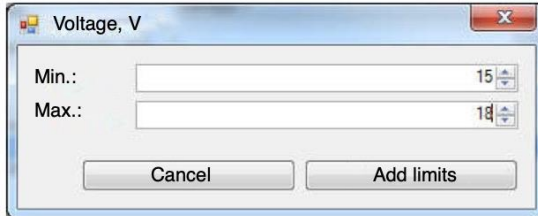


Fig.16. Setting Control Limits.

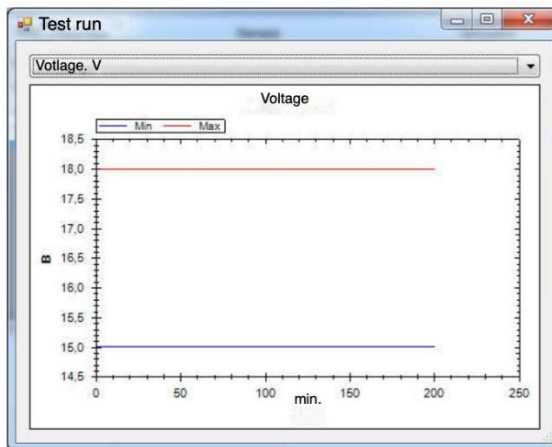


Fig.17. Test progress.

In the “Test run” window, you can see the voltage dynamics during the test, where the red line indicates the maximum voltage and the blue line the minimum. For example, in (Fig.17) during the test, the voltage max and min reach the previously specified limit.

Thus, the system control and camera control provides the required state standards and technical regulations accuracy tests, and enables the processing of the data.

4 Software Deployment

A deployment model is an object model that describes the physical placement of subsystems across the compute nodes of the system [7, 8].

The system is deployed according to the diagram presented in (Fig.18).

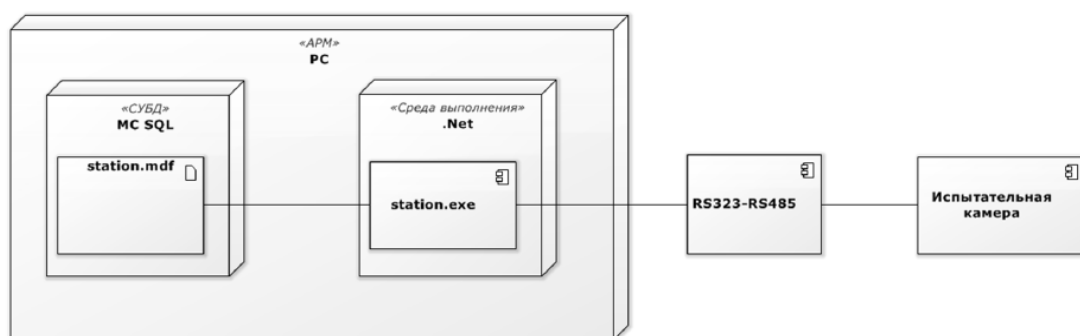


Fig.18. Deployment Chart, a camera on the right end, connected to the RSxxx device.

The application is installed on the operator’s computer and runs in the environment network or standalone. The database must be installed locally with the program. A RS232-RS485 transceiver is connected to the computer via the RS232 interface. Test cameras are also connected to this transceiver via RS485 interface.

Conclusion

Development of software for automated workplaces can significantly improve the quality of testing and data operations on the climate chamber included in the system.

It improves the ability to organize the management of cameras by a single engineer and provide comfortable conditions for his work, while reducing costs on the organization of jobs.

The use of a computer allows not only to automate test, but also to perform unique management of measurements.

Design of the software allows to the test engineer to observe the testing process and to accelerate the process tests, because measurements of the required parameters are performed in automatic mode, where you can quickly receive reliable statistical information. A parallel manual performance of such work is almost impossible due to the time consuming.

Thus, the system control and camera control provides the required accuracy tests by state standards and technical regulations and enables the processing of the data.

The results of the work can be presented in the form of charts and by the automatically filled out report forms with test results for each product.

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