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Nextion Tft Development an Experimental Survey for Internet of Things Projects

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Abstract: ***This article presents the results of an experiment with a project involving the Internet of Things, which presents the main characteristics of the devices used for automation, the Nextion display device was used as a demonstration model, because it has low cost and mainly ease of solution constructions, which require a touchscreen display for electronic designs. A small solution was developed with the purpose of presenting its main functionalities in a real project, which could contribute to the development of more sophisticated projects, serving as a bibliographic reference base for scientific projects. The results presented the facilities and great possibilities of using the device to develop projects of different sizes.***

Keywords: iot; nodemcu; nextion; display; tft.

I. INTRODUCTION

With the growth of studies on the Internet of Things in the international market, we see the need to create materials that can serve as a basis for research in university projects, among others that involves academic studies, this study proposes the creation and presentation of a model a basis for development, which can serve as a basis for future projects, contributing to scientific research, serving as support for studies and the creation of quality projects.

As a general objective, this study presents the results of an experimental research, in which the methods and techniques developed by studies, reading of documents and technical materials, were used according to the instructions of manufacturers and technicians. An application has been developed which demonstrates the use of these techniques using the Nextion tft 2.4" device in conjunction with other development tools.

This study was developed between 2017 and 2018, being considered academic bibliographical references, books, technical materials, articles and manuals of manufacturers, as well as personal experiences of the author, with the development of solutions for research projects that involve the topic the Internet of Things. The resources used involve the interdisciplinarity, since the universe of knowledge and necessity for the use of various resources from different areas of study is observed.

This study is divided into a review of the literature, in this topic we discuss the main materials that were used as a study base for the development of this article, method and materials, in this topic are presented the methods and materials, such as devices, development tools, among other materials that served to the research, finally the topic of results and discussions, in this are demonstrated the main steps, concepts, programming codes discussing their use and results.

II. Bibliography Review

During the bibliographical survey, research was done on the main subjects involved as Internet of Things, Display Nextion, resulting in few relevant content that could collaborate with the study, because the subject on the Internet of things has still few materials of scientific content, most of which are technical materials with documentation and product manuals available from manufacturers, this has led to the need for comparative studies among devices as presented by Bento [2].

The Internet of Things is the use of devices that allow communication between objects at a distance in different formats, for facilitating portability, allowing access in different devices, the main sources of information about the Internet of things are based on information study available from CERP [5] and ITU-T [10], which classify the Internet Internet of Things as: The use of things or objects that communicate with each other over networks at a distance.

The Internet of Things was analyzed during this study, considering the different types of projects and applications of its main resources, evaluating bibliographical contents, technical, articles and documents, considering their applicability that support the construction and use that can provide results compatible with those desired for the creation of the prototype.

The bibliography on the Internet of Things had as basis: [1][2][3] Arduino, [2] CERP, [5] Cui, Xiaoyi, [8] Hgai, Edith C.H.; Dressler, Falko; Leung, Victor; Li, Mo, [9] ITU-T, [10] Kara, Sami.; Li, Wen, [11] Larrucea, Xabier; Combelles, Annie; Favaro, John; Taneja, Kunal, [12] Li, S., Xu, L.D. & Zhao, S, [13] Ma, Junyan; Zhou, Xingshe; Li, Shining; Li, Zhigang, [15] Minerva R, Biru A, Rotondi D, [15] Mukhopadhyay, Saibal; Wolf, Marilyn, [16] Mung, Chiang; Sangtae, Ha; Chih-Lin, I; Fulvio, Risso; Tao, Zhang, [17] Niyato, Dusit; Maso, Marco; Kim, Dong In; Xhafa, Ariton; Zorzi, Michele; Dutta, Ashutosh, [18] Verikoukis, Christos; Minerva, Roberto; Guizani, Mohsen; Datta, Soumya Kanti; Chen, Yen-Kuang; Muller, Hausi A, [19] Vermesan, Ovidiu; Eisenhauer, Markus; Sundmacker, Harald; Guillemin, Patrick; Serrano, Martin; Tragos, Elias Z.; Valiño, Javier; derWees, Arthur; Glubak, Alex; Bahr, Roy, [20] Wolf, Marilyn; Serpanos, Dimitrios.

The subjects involving the display Nextion were studied on the materials available by [2][3][4] Bento, A. C, [4] GitHubIteadLib, [5] GitHubLibNextion.

III. Method and Materials

As a method of development of the research project, we used the experimental research model, in which experiments are performed with devices and software to present solutions to the research problem, the problem involves the need to create a solution that meets the requirement of a project for reading and access of devices used for the Internet of Things, considering the ease of use and for the creation of software for the manipulation of the devices.

The first steps were developed on the study of bibliographical materials, which served as a basis for the development of the solution, due to the difficulty of finding scientific references on the subject addressed, also used documents, manuals, discussions in forums and blogs, these contributed for the structuring of the study, being the most important references for this study.

After the studies and bibliography, systematic searches were also carried out in online databases such as the IEEE Xpress, soon after the techniques were applied and the experiments were developed, initially the devices were chosen, for this study was used the model with display of size 2.4 inches, this being necessary for the project, for its low cost and for the presentation of the results, which at the moment, did not require better resources.

The materials, tools and software were selected for their low cost and ease of use, considering the type of project, being developed as a prototype to present a practical application of the studies, with the Nextion display, a mini USB cable was also used, a MicroSD used to upload the code to the display, the ITEAD Nextion editor design software was used to create the screens, using features as described in the technical documentation, a Compaq Presario notebook was also used.

IV. Results and Discussions

The initial steps for using the Nextion display are very simple, it is first necessary to install the software for editing the ITEAD Nextion Editor screens, this should be the main tool used during this study, it was installed in the Windows version, a Compaq Presario notebook for development, the notebook has Windows 10 64-bit operating system.

Shortly thereafter a microUSB adapter was used, which already comes with the Nextion device, as shown in Fig. 1, in the same set of accessories a TX / RX transmission cable is also available for data adaptation and transmission. the connections for 5V power, red cable and ground wire black cable.

The model used for the project has a 2.4 "display, which is sufficient for the development of the solution. The Nextion device was selected because a previous evaluation by Bento [2] was developed, which demonstrated the main advantages of this device, in this case are highlights: easy development, low cost, touchscreen feature, reduced amount of programming code, these qualities are compared to other devices with the same feature.

The solution developed allows to demonstrate in a practical way the creation of a project that allows to configure the devices used during the development of solutions for the Internet of Things, as presented by [1] [3] [8], deal with the use of devices that are interconnected by communication via radio or WiFi, allowing the exchange of information and control of devices at a distance, usually these configurations can be performed by WIFi or by direct connection to the device, which makes it difficult to access and create different solutions to suit the project.

Fig. 1 Nextion display devices with accessories, cables and microUSB connector.

As shown in fig. 1, the Nextion display device comes with the accessories: a cable with a connector for transfer and power connection to other devices, the microUSB connector, allows to connect to the power in isolation, making the cable available only 2 pins for TX / RX transfers, the microUSB connection can be made on any computer with 5V input.

In a market survey, the Nextion display device can be found easily in various websites and retail stores for electronic products with low cost [2][3], the values for the 2.4 "screen configuration can be found with values averaging USD $ 10 , 00. With good documentation, details for use of the product can be found on the manufacturer's website GitHubNextion [2], [4], [5]. The tests were developted using only the device, without connections with a central as an Arduino or a NodeMCU12e controller.

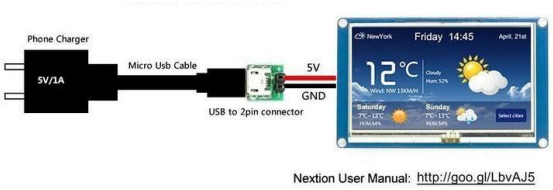

Fig. 2 Nextion display devices connected with micro USB adapter.

This is the most critical point of the project, as any incorrect connection can damage the devices and the computer, noting in the documentation of the device, which specifies that the connection pin with the + (positive) signal represents the use of the cable that carries power, in this case it is the red cable, the pin with the - (negative) signal represents the cable that does not carry energy, in this case it is the ground cable of black color [2][3].

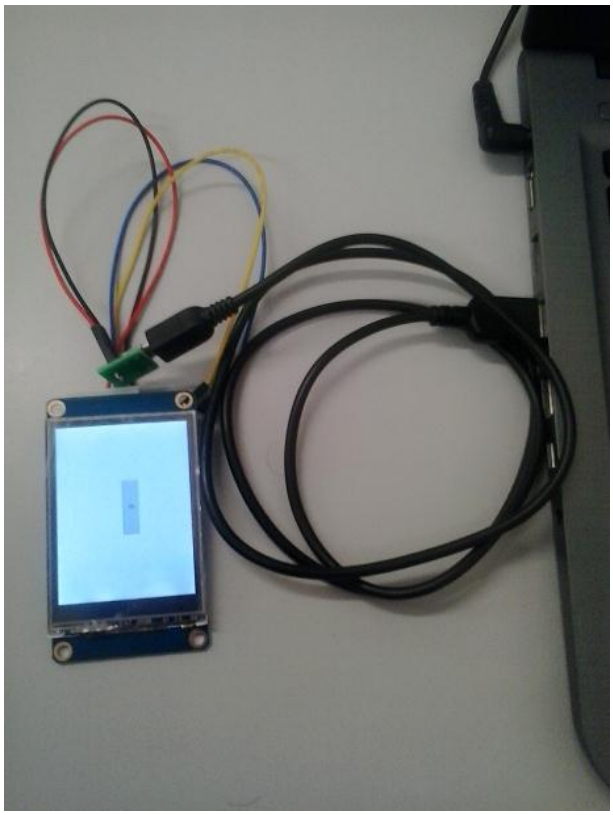

Fig. 3 Nextion display devices connected with micro USB adapter with a notebook.

The TX and RX cables are used to transfer data between the NExtion device and a controller, such as an Arduino or a NodeMCU12. For this project, the TX and RX cables should not be used, as the Nextion device, this type of project is useful to eliminate the amount of processes performed directly in the controller, because as the Nextion device has a good storage and processing capacity, it is advisable to use the available resources, in a balanced way, avoiding overload in the processes

After the necessary connections it is necessary to install the Nextion software ITEAD software on the computer, this should be the main tool for the development of the solution, the software already contains some examples of creation and use of the device, based on these models and available documentation was developed the example that was used during the development of this process.

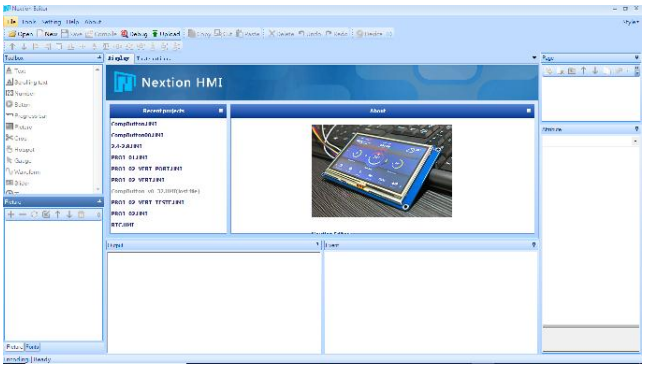

Fig. 4 Nextion screen editor.

During the creation of a new project the screen editor of Nextion will ask for information such as what type of device, how large the screen should be, also the screen layout should be requested, whether it should be vertical or horizontal. Depending on the need of the project it is necessary to select the correct model, any subsequent change, may cause rework to adapt the project and its elements with the new screen layout.

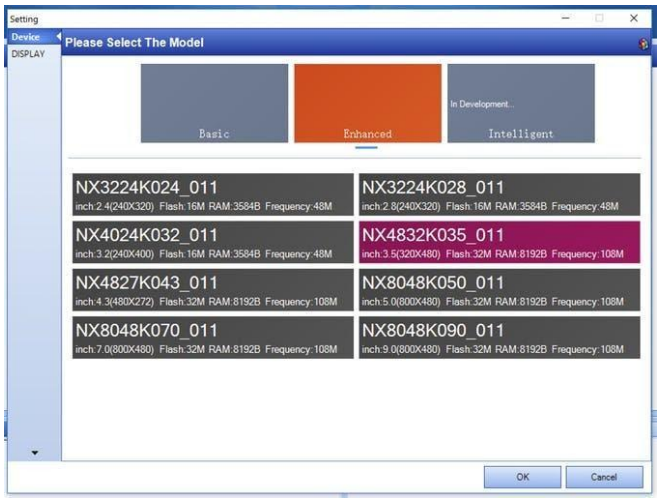

Fig. 5 Nextion screen editor, screen layout and device selection.

For this project, the Nextion NX3224K024_011, inch 2.4 (240X320) Flash 16M Flash 3584B Frequency 48M model was selected, it is important to select the correct model, as problems with models and incorrect configurations may occur during project creation, in tests prior to the change of a model for horizontal to vertical layout, required a new screen reshaping and arrangement of objects, it was practically necessary to redo the project.

The product line of the Nextion display is very large, there are very large touch screens as shown in fig. 5, there are screens up to 9 inches at the moment, depending on the type of project the use of this screen size is necessary, in this context, it is also necessary to evaluate their real need, as some types of controls can be performed by WiFi, in this if a tablet would solve, being this one with lower cost and greater capacity.

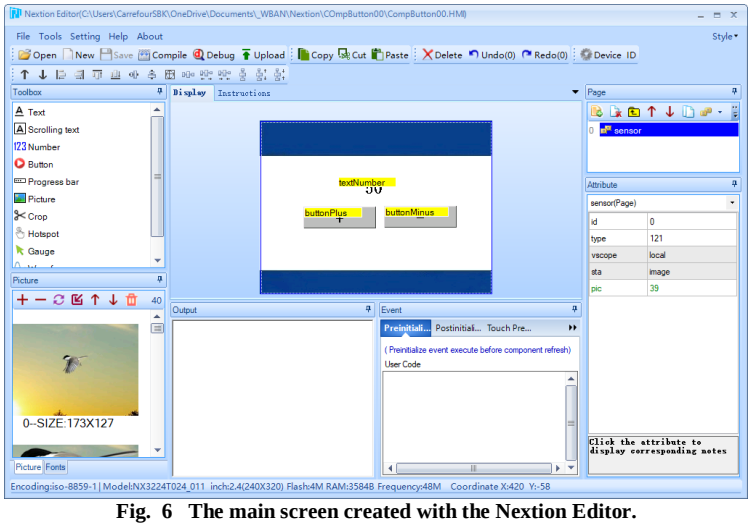

Fig. 6 The main screen created with the Nextion Editor.

In the upper bar, there is the main menu with various tools and screen configuration options of the font types used, layout among other possibilities. What is interesting is the possibility of a specific type of font for text, allowing the combination of different types of characteristics.

In the first set of objects in the upper left side (Toolbox), the objects that are to be dragged to the main screen, which is in the center of the project, are available, there are different types of tools such as: text boxes, figures, numbers, slides , buttons, timer, checkbox, that is, various object options which are normally used in programming languages, such as Microsoft Visual Studio.

For each object selected, there are specific properties of each of them, some are very important to know, such as the name of the object and its code, these data are very used to call the component during the development of applications by the controller, as in Arduino, for example, the attributes appear on the right side of the menu, other options are available as: position on the screen, height, width, object text, color, text font type, size.

Just below the Toolbox is the image control box, the images are included when uploading the files to the Nextion Editor, when dragging a figure object, for example, it is necessary to inform the object code, in case the figure which has been uploaded to the editor, this way the link of the image object is realized, with the desired figure, after selecting the figure, it may be necessary to make configuration adjustments for the position and layout on the screen.

Another important component of the top menu is the debug icon, in which it is possible to verify the project in operation, as if it were in operation in the controller, so the developer can develop rum operation test before putting the project into production, thus avoiding a great loss of time, because every project is necessary to load it on the Nextion display.

Also in the top bar there is another icon for compilation, this object allows to create the solution package HMI, which should be uploaded to the Nextion display, using a MicroSD, this process must be performed with the display off, to the link it is necessary to keep the MicroSD in the Nextion display slot, when it is switched on, it should start uploading the code, showing the percentage of upload during loading, after loading, the Nextion display needs to be restarted.

In projects with devices for the internet of things, usually each device has a type of configuration which is usually defined at different points in the project, such as in some sensor that needs to measure some type of sensitivity, such as heat, cold, humidity, it is necessary that there is some kind of limit to trigger an alarm, for example, if a heat sensor receives information from the environment, that the local heating has reached the 50 degree point, the system may alert, or send a message to some other object in order to start a monitoring control.

In other situations, for example, to perform a date and time control, for storage in another device of the type clock or RTC, it is necessary that the user inform the local date and time, this data must be stored in the device, to control for example, sending the event to a remote database, or even to be written to another device.

Another example of application of this solution, depending on the project it may be necessary for the user to have access to the WiFi network of his residence, for this he will need to inform in some way the user name and password, this solution will enable the user to inform this data, the which should serve for the connection in the home network, the controller would only receive the data and record it in some other memory for future consultations, thus avoiding the user to directly access a WiFi network, which could be available only in the controller, with an ESP8266 device, for example.

For this project only four objects should be used, a screen with two buttons and a numeric field, the buttons to be pressed, should change the values of the text field, in the case a button was created called + which should add a value in the text field, and another called - which must subtract a value from the text field, thus allowing a storage and control of the data being presented, the value limits must be determined, for the minimum value is zero, for the maximum value is 50.

The algoritmo will increase one digit for the numeric field, if the increase button is pressed, and substract one numeric digit if the decrease buttons is pressed, the language for Nextion development is very common as a high level language, where the expression. Is used:

If (numericfield < 50) then

numericfield = numericfield +1

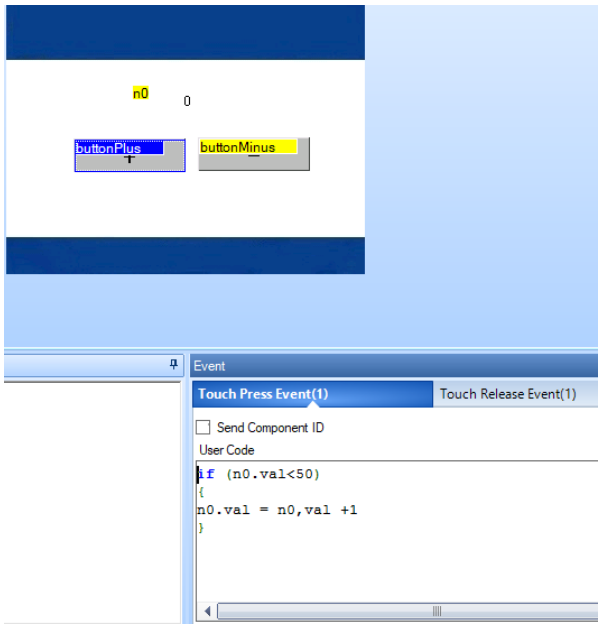

Fig. 7 The increase digit algoritm using the Nextion program language.

With the same way the algoritm for decrease value wil be if (numericfield>0) then numericfield=numericfield-1. During the debug operation, is possible to verify the algoritm working correctly, as shown the fig. 8.

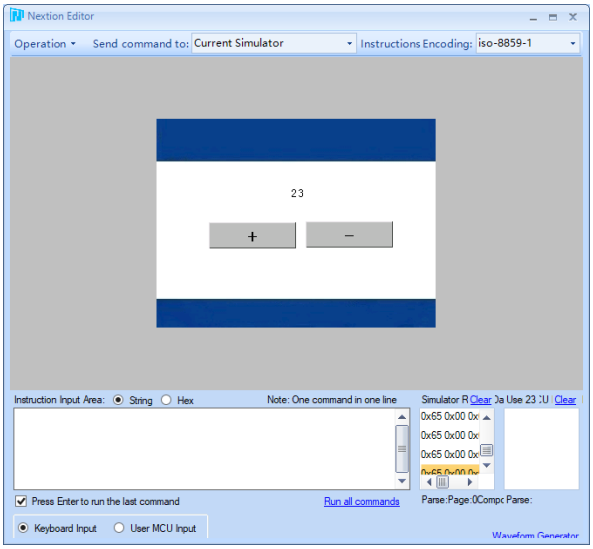

Fig. 8 The debug screen with the Nextion editor.

After these steps, it is only necessary to compile the project, send the HMI file to the MicroSD memory, then load the project to the Nextion device. With these results, it was possible to validate the application and demonstrate the ease of operation and creation of solutions with the Nextion display editor, allowing the creation of a functional solution, which contributes to the development of more sophisticated solutions for more complex projects.

V. CONCLUSION

As conclusion, the results allowed to observe and understand the process of building a viable solution, with low cost and with ease of construction, providing great new possibilities of application in different types of projects, allowing researchers to use this type of application in their studies and prototypes for automation and solutions in internet of things.

Currently, there are different types of devices for building solutions for the internet of things, many of them use all the communication points of a microcontroller, the Nextion device, allowing the creation of a solution quickly and simply, also allowing the use of other sensors and devices connected to the same controller, this is a great advantage compared to other types of displays available on the market.

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