Review of Google Blockly and its Innovative Use

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Abstract— This paper gives a review about Google Blockly which is an open source programming library developed by Google to add block-based code to an application. It provides a graphical editor user interface and a code base for generating code in different programming languages. The paper also illustrates the working of Google Blockly with simple examples and reviews the applications of Google Blockly in various professional areas; focus is given on the innovative applications areas where Google Blockly can be used.

*Keywords—*Google Blockly, Blockly, Ebot

I. INTRODUCTION

It is difficult to think about the modern world without computers. Computers have made our lives easier by doing complex and repetitive tasks quickly and efficiently. Many commercial and free software is available for doing different kinds of tasks on a computer. But you may require developing software for a specific task that may not be available commercially. Even though programming has many advantages, learning to code can be a really a tricky task and can take a lot of time to master especially for the common people. This is where Blockly comes into the picture. Developed by Google, Blockly is an open source library that makes it easy to add block based visual programming to an application. It is designed to be flexible and supports a large set of features for different applications. It can be used for programming, animating characters such as in video games, creating your own scripts to accomplish/schedule predefined tasks (e.g. as sending an Email at 11 am), controlling robots in factories and even in applications for surgeries in hospitals. Blockly is not itself a programming language, developers who use Blockly create their own block languages. When developers want their clients to develop their own logic inside the app they can create an app using Blockly. The paper reviews and discusses the working and application areas of Google Blockly. It focuses on the innovative applications areas where Google Blockly can be used.

I. RELATED WORK

A. Survey of Google Blockly in professional areas

1. EBot Blockly

Ebot (Educational Robot) Blockly is a great app developed using Blockly. It provides virtual educational kits containing three platforms electronics, mechanical and software. The idea is to provide the users with basic knowledge of how each component works and how they can be combined to make a larger project. It acts as a prototype for testing new ideas without buying any real components.
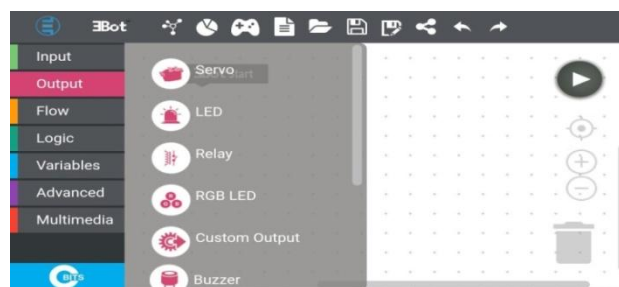

Figure 1. Ebot Blockly - Tools and Interface

Not all users from electronics or mechanical field are aware of programming and hence it provides a graphical interface to build logic. This design can be then converted into C++ code which can be executed [1].
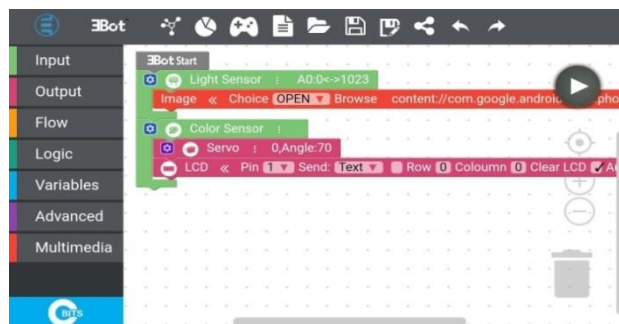

Figure 2. Building logic using Ebot Blockly

2.   CPF Arduino Blockly

CPF Arduino Blockly is a great tool to learn and code hardware. It supports Arduino Leonardo via Acer Cloud to communicate with available hardware. It provides assembly instructions and remote control features to control all your devices and also helps to log reports.

Figure 3. CPF Arduino Blockly Interface

The app uses prewritten functions which are designed to eliminate the time required to operate hardware at the base level. This increases coding speed and efficiency. Since it uses Arduino as an interface between Google blockly and real hardware, it can support all hardware supported by the Arduino. All of this hardware is included under CPF devices section of the app.
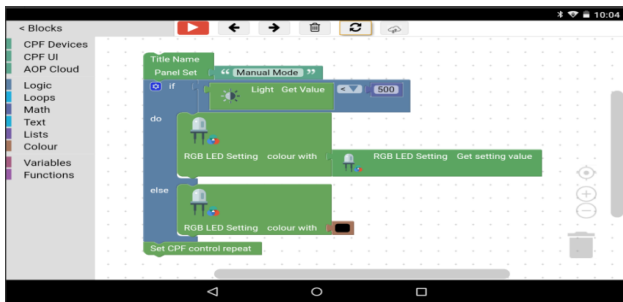

Figure 4. Building logic using CPF Arduino Blockly

II.   HOW BLOCKLY WORKS

Blockly is a Visual Programming Language (VPL) i.e. it allows users to generate programs through graphical manipulation. Some common types of VPLs are:

• Dragging blocks around a screen (e.g. scratch)

• Using flow diagrams, state diagrams, and another component wiring (e.g. Pure Data)

• Using icons or non-text representation (e.g. Kodu)

Blockly is an open source programming library developed to add block as coding to an application. It provides a graphical editor UI and a code base for generating code in different programming languages. Blockly supports popular generating code in popular languages like PHP, JavaScript, and Python. Developers can even use it to generate custom code in other languages. Since the library is written in JavaScript, it can be used in any website, web application or can be embedded in a Web View. A limited version of Blockly is also available to use inside Android and IOS applications for building high-performance mobile apps. [2]

Blockly provides the certain set of rules and a representation for programming that can be used inside any app. Program logic is represented by blocks of different shapes and colors which can be moved around by dragging. Each block has a specific meaning and a code block associated with it. For example, a green block represents a while loop which can be used as a set of tasks until a certain condition is true. Also, note that the condition is also defined as a navy blue block. Each of these blocks has a connecting point which can be used to attach multiple blocks and form a larger block.

Similar to functions in programming languages, these blocks can be defined as a function which can be reused to do a certain tasks without having to rebuild the same block again.
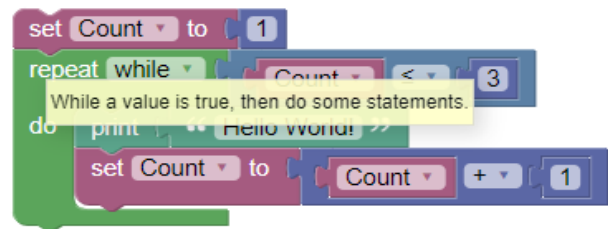

Figure 5. How Blockly works

A. The above block will print "Hello world!" until the count is less than 3 as described in the condition block. Even Though this is a simple example, many complex operations can be performed using similar techniques.

B. The output from these blocks is a block of code which can be executed in real-time by the user [3].

Natural Language

Syntax complexity is very frustrating while learning a new computer language. Not everyone can understand computer language vocabulary. To allow common people to be able to generate logical blocks, Developers can integrate natural language blocks inside their applications which are easily understood by anyone. Natural language blocks use

standardly written sentences for most of their blocks. Blocks that use readable sentences can be used to express more complex concepts than icons, while still feeling familiar and intuitive for users. If used well by a developer, users of any age can use Blockly and find these experiences fun and be challenging. Scratch is a popular creative coding app for kids and teens is a great example of a block language in this category with long-term appeal.
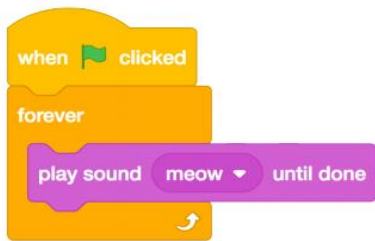

Figure 6. Blockly using natural language

Above figure shows a natural language block which will play a sown when the user clicks on an object. Such blocks can be created and manipulated even by small kids. Fun challenges can be designed using such blocks for school children to improve their logical reasoning abilities. Such blocks are much more intuitive and fun for learning as compared to complex computer languages [4].

III.   INNOVATIVE APPLICATION AREAS WHERE GOOGLE BLOCKLY CAN BE USED.

1.   Google Blockly as Captcha

Captcha is a computer program or system used to identify machine inputs; this can be helpful for detecting spam and automated extraction of data from a website. Captcha ensures that the input is given by a human, not from an automated source.
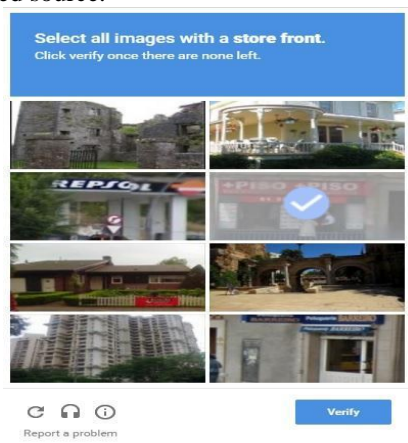

Figure 7. Traditional Captcha

Traditional captcha uses images which are pre-identified by humans, thus those images can be used to identify human inputs during runtime. This is done by using random object images or random text, even though it is easy for humans to identify such images it is very difficult for a computer.

Blockly can use similar concept where instead of images, blocks are displayed to the user and the user supposed to rearrange those blocks in a meaningful manner. The blocks must be arranged in such a way that the output of the combined block would make a meaningful output such as a password. Even though identifying complex images is difficult for a computer, identifying blocks and rearranging them in a meaningful manner is the more difficult task for a computer or a robot, this can greatly improve the captcha security and avoid automated inputs. An example is shown in the image below.

Consider the example shown in the figure, the user is supposed to move the blocks in such a way that the answer is 5. This can be done by arranging the blocks in the order: 8 - 7 * 5. Note that even though computing numbers is easy for a computer, identifying the problem is a challenging task especially when the problem changes every time. Also, the captcha blocks can use logic for generating more complex problems which are easy for a human to solve.
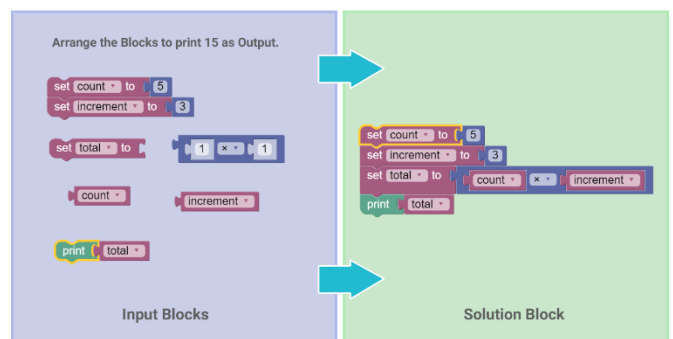

Figure 8. Blockly as Captcha

Advantages of blockly over traditional captcha:

● In traditional captcha images needs to be pre tag by human sources so that they can be identified later, this process requires a lot of time and manpower whereas in blockly no images or manpower is required and hence it is much faster to implement and economical to maintain.
● Since no images are required only textual information is sent to the client machine during runtime and hence it requires fewer data and loads much faster than traditional captcha.
● One of the major benefits of this technique is that these blocks can be auto-generated by a pre-written algorithm every time a request arrives.

2. *Google Blockly as Password*

Traditionally the Passwords are used to authenticate the validity of a user, but along with a password, the captcha is required to eliminate spam or automated computer inputs. With Google Blockly both, the steps can be combined into one block where the user is supposed to rearrange the blocks to form his/her password.

Since both the steps are combined into one step it required much time for the user to log in. Also rearranging blocks is much intuitive and faster way to enter a password rather than typing a complex string of text/captcha. Consider the example shown below.
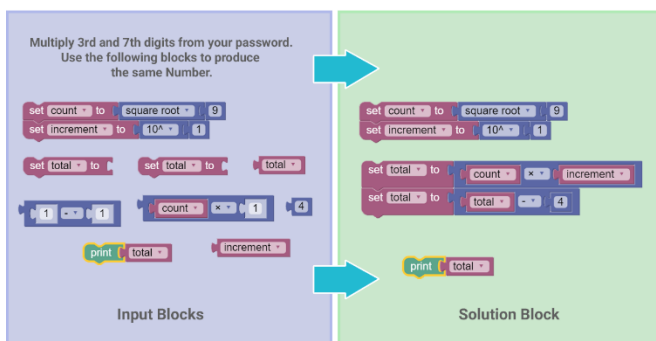

Figure 9. Blockly as Captcha and password

● The user is supposed to multiply few digits from his password and then reproduce that password in the form of blocks.
● He also has to calculate how many times the blocks are to be repeated to form the same answer.
  Advantages of Blockly as Password:
● Traditional passwords require the user to enter a string using a keyboard. This password can be easily hacked using a keylogger program whereas in blockly no keyboard is used and is much difficult to hack.
● Password requires you to remember complex string which might get lost since blockly relies on logic which changes every time and the user is not required to remember complex passwords.
● Blockly is much safer than traditional passwords.

3. *Google Blockly in Industry*

Blockly can be very helpful in applications where a new process is required every day. It is not economical to hire a software team to redo every day and also a lot of time will be wasted in the process. Even Though it is possible to build GUI that can accomplish this task, GUI can get very complicated as the complexity of the application increases. Such GUI will be hard to learn and understand. Also, the probability of a human error will be much higher because of its complexity.

Blockly can accomplish the same task with a much simpler GUI. Also, the time required is much less and there is less chance of human error. No software professionals are required to do the same. A highly simplified example is shown below.
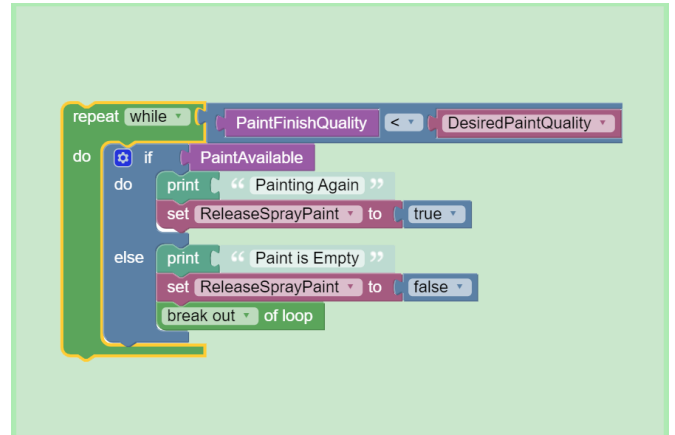

Figure 10. Automation using Blockly

Consider a robotic paint system where the actual process of the painting changes every day based on the side and type of vehicle.

● Blockly programs can be changed instantly without having to recode the entire program by a software engineer.

● Anyone can change the paint program by rearranging the blocks or the changing the number of times the painting is done.

● This can help to cover a large number of vehicle types and also eliminate the time required to recalibrate or reprogram the software.

IV.   CONCLUSION

Google Blockly is mainly used by developers or new programmer. It can be used for developing there logical and arithmetic thinking and also gives a freedom to code error-free programs and also who don't know the basics of programming they can also understand the logic due to its simple vocabulary. Besides this, Google Blockly can be also used in various application areas like captcha, password and in commercial use.

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