The Quantum Decision Maker

Logan Pratico

September 2020

Introduction:

The Quantum Decision Maker liberates the user from ever having to make a decision again. Upon pushing a button, a signal is sent to a quantum random number generator[1] (QRNG) using the quantumrandom[2] Python library.

The Quantum Part:

Simply put, a QRNG exploits quantum processes to produce true randomness. More specifically, the QRNG measures quantum fluctuations in amplitude at all frequencies within a vacuum.[3] In quantum mechanics, the amplitude can be used to calculate the probability that an observed particle will collapse on a certain position (the greater the amplitude the higher the probability that a particle will be observed in a given position. But what makes this random? Because we are observing the position of a particle within a wave function, and because quantum theory states that until a particle is observed, it exists in a *superposition* of every possible position it could be in, when the particle is observed, the position that the observer perceives is completely random.

A QRNG capitalizes on this fact to assign a number to the various positions in which a particle can be found. Once the particle is then observed, the number associated with it is then returned. With the Quantum Decision Maker, there are only two choices that can possibly be made. Thus only 2 possible numbers can emerge from the QRNG (0 or 1). Luckily, this fact makes the process quite similar to the Schrödinger's cat thought experiment[4] with a 0 returned when the cat dies and a 1 return when it lives.

But how random is it? Well, it's so random, that one interpretation of quantum mechanics, known as the Everettian or Many-Worlds Theory, states that for every possible position, a new universe is created in which a different position was observed. The Quantum Decision Maker capitalizes on this theory to provide a tool that allows the user to simultaneously follow both choices in a decision in parallel universes. That is, when a position is observed, the universe splits in two, creating one new universe where a 0 is returned (and choice 'a' is followed) and another universe where 1 is returned (and choice 'b' is followed). There, is of course, no way to ever communicate with the other parallel version of yourself that chose the other option.

The Hardware Part:

The Quantum Decision Maker was created using a Raspberry Pi with 2 LEDs, 7 resistors[5], 1 four-digit display, 1 shift register[6], 1 GPIO Extension Board, 1 Bread Board, 1 Button, and a whole bunch of wires. *Figure 1* shows the circuit built using the Da Vinci kit for Raspberry Pi.[7]

---

1 https://qrng.anu.edu.au/
2 https://pypi.org/project/quantumrandom/
3 In quantum physics, a vacuum contains a sea of virtual particles, appearing and disappearing at all times. This differs from a vacuum in classical physics which says that the same space is empty of matter.
4 https://en.wikipedia.org/wiki/Schr%C3%B6dinger%27s_cat
5 A resistor implements electrical resistance as a circuit element. It is used to reduce current flow.
6 The 74HC595 shift register receives data serially and then sends out this data through parallel pins.
7 https://github.com/sunfounder/davinci-kit-for-raspberry-pi/blob/master/docs/(EN)%20Da%20Vinci%20Kit%20for%20Raspberry%20Pi%20User%20Manual.pdf

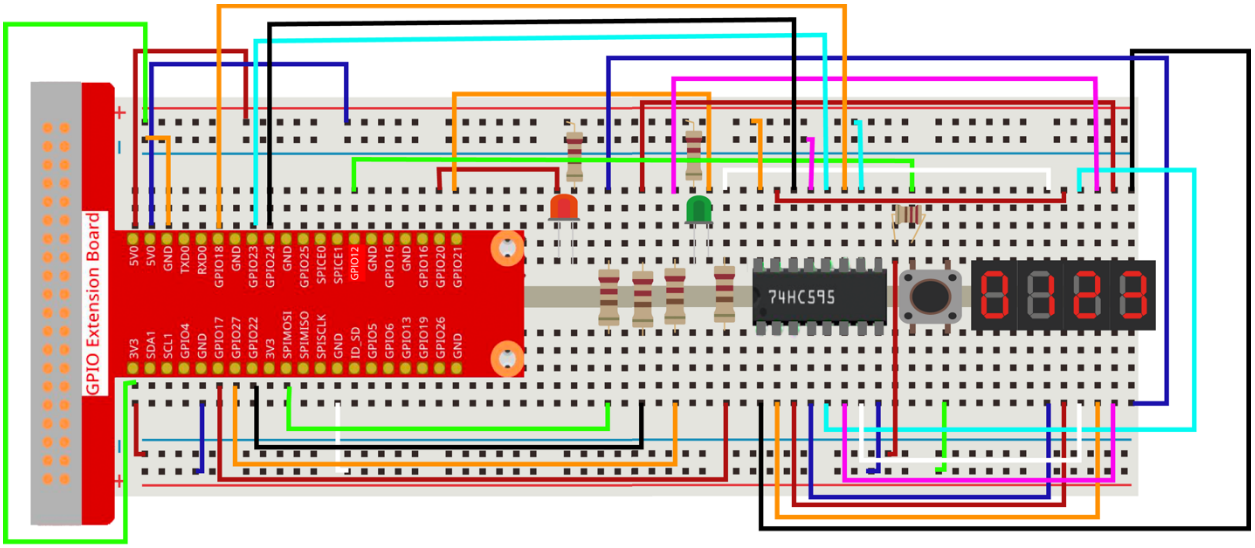


Figure 1: Quantum Decision Maker Circuit Diagram

The Code Part:

The underlying code was written in Python using the quantumrandom library. Once the button is pressed, a signal is sent to the ANU Quantum Number Generator. From there, either a 0 or a 1 is returned. In the case that a 0 is returned, a signal is sent to the red LED and it lights up. If a 1 is returned, a signal to light up the green LED is sent. Following this, the 'numbers.txt' file is then opened, containing the number of theoretical universes created according to the Many-Worlds Theory.[8] This number is then doubled and printed to the four-digit LED display. The number of universes grows exponentially. Thus, if 3 decisions have been made, 8 separate universes will have been created (1 universe splits into 2, which then split into 4, which then split into 8). After this number is printed it is then written to the text file and saved. The program then waits for additional input from the user in the form of a button press.

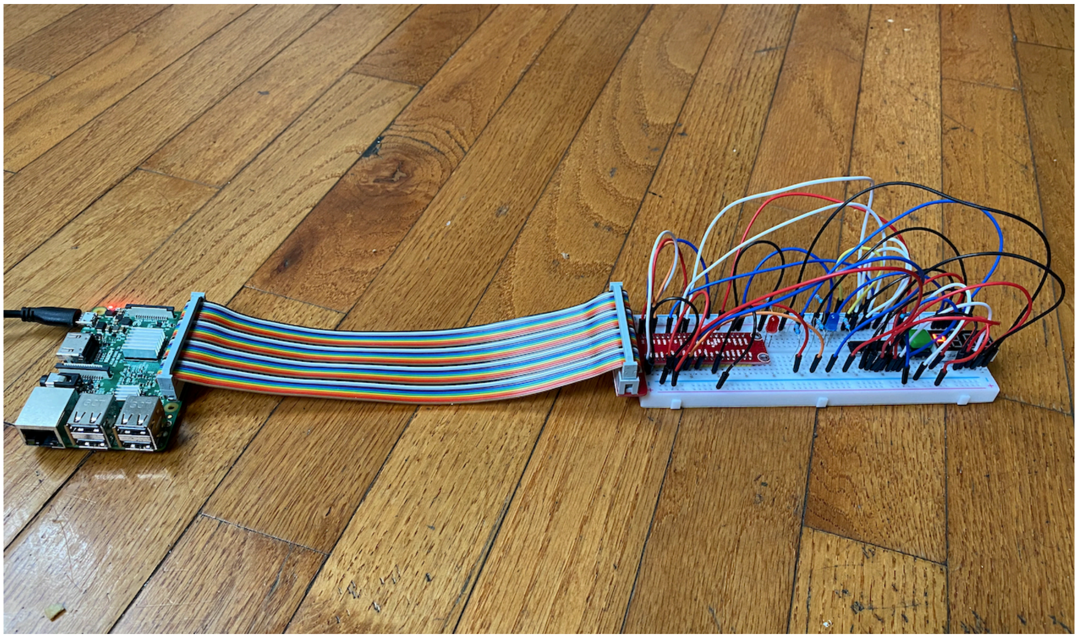
Concluding Thoughts:

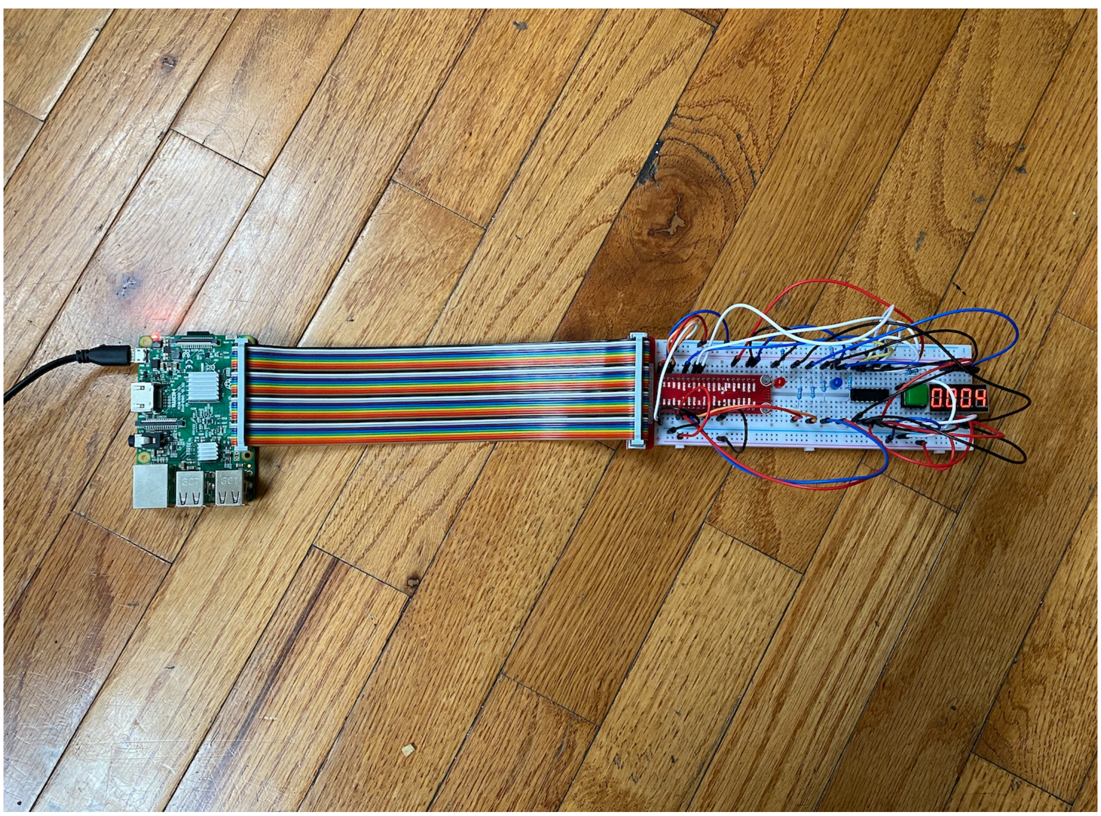
The Quantum Decision Maker was created as a fun project to explore the Many-Worlds Theory as well as the hardware capabilities of a Raspberry Pi. The project aimed to blend the fields of Computer Science, novice hardware engineering, and quantum theory. Anyone interested in recreating the project can find the code here: https://github.com/Logan-Pratico/quantumPi. Any question can be directed to logan.m.pratico(at)gmail(dot)com.

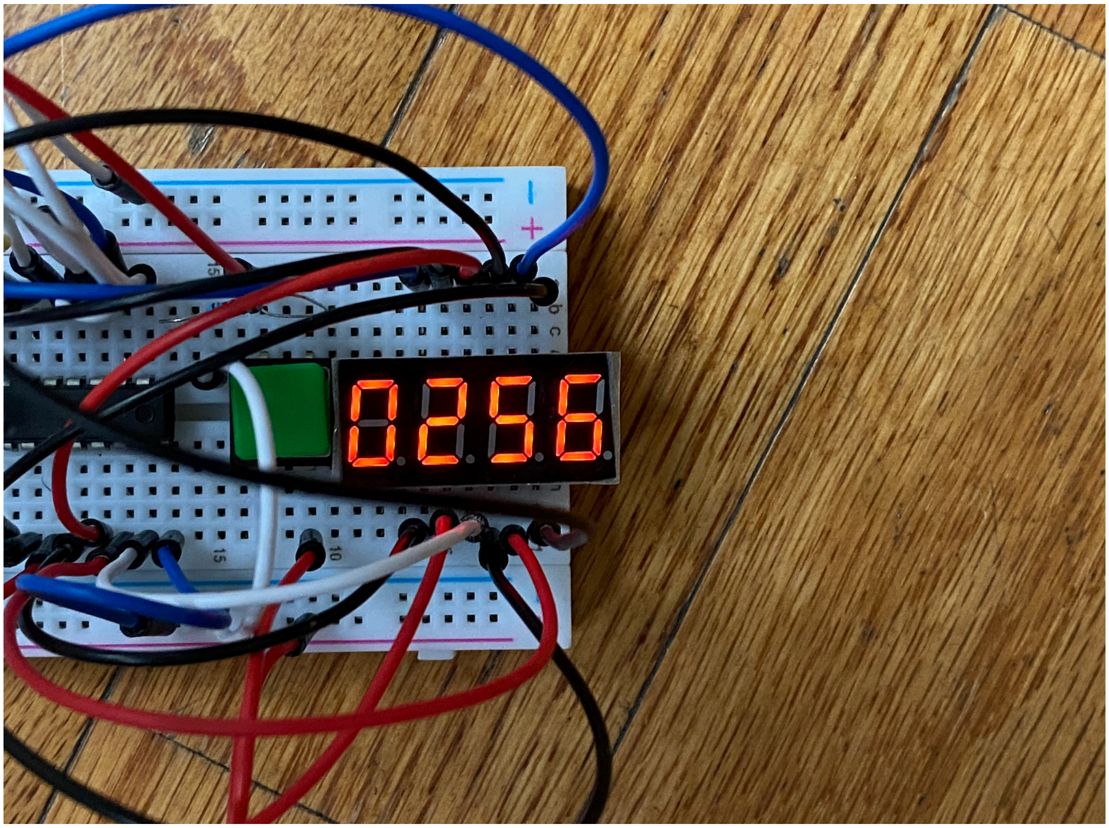
---

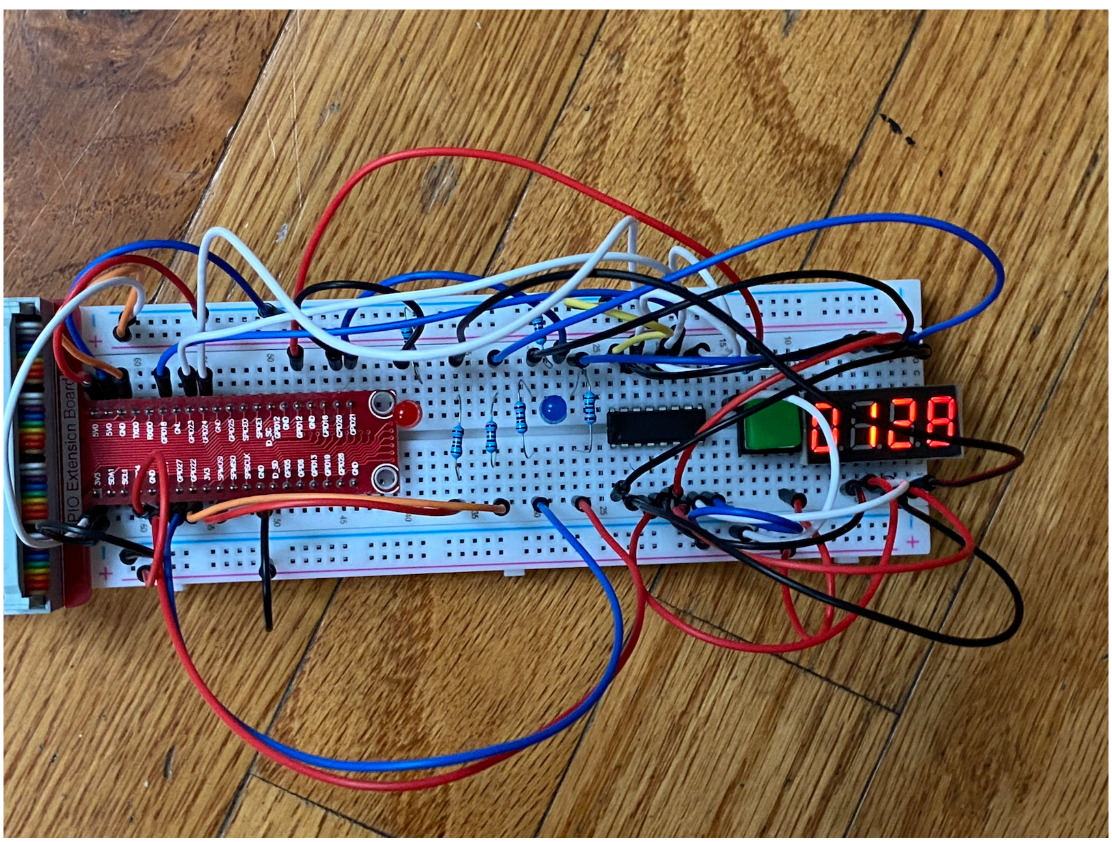
[8] https://en.wikipedia.org/wiki/Many-worlds_interpretation

Gallery






0256


0129