**Pacman Firmware**

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The Pacman game firmware includes many different components, these include the following:

* Uart functionality to allow users to move of pacman, this also includes the upeek() function allowing for checking if a user has inputted anything, then the ugetc() function is used to retrieve the value presented by the user.
* A graph which is created using the characters M, P, W and V, each represent a different element in the game environment such as walls, points, walls and empty spaces.
* BMP images are used to generate the different sprites displayed in the game; the BMP files are read as a set of coordinates which ends up as a grid that can be read by the qemu emulator.
* Each of these sprites (pacman and the ghosts) do not leave a copy of their sprite behind them through a function called putback(). Using another function called black\_point() whenever the user walks over points (P) it is then replaced with an empty space (V).
* Each of the enemy ghosts uses dijkstra’s algorithm to find their way to the pacman.
* A collision check ensures that the user and ghosts cannot walk into a wall this is done by ensuring that the next area in the graph is not a wall (W).