Claims

1. Real time system for the two-directional memorisation and transmission of the controls and data for a processor (24) in the I/O process, with external serial peripherals (21) such as graphic tablets and/or digitisers for the handwritten signature, characterised in that it uses an external medium (22) for the memorisation of static data so as to constitute a transmission buffer capable of operating with the serial peripheral unit (21) seen as a "USB drive" removable virtual disc, on such external medium (22) there being configured only one file constituted as a linear sequential succession of data in the constant dimension sectors, which can be shared between the serial peripheral unit (21) and the processor (24), which can both read it and write it, in parallel, thus defining an asynchronous I/O transmission with data block contents of the order a Kbyte and a memorisation area actually as large as desired, however definitely larger than a data packet, used as a temporary buffer for data awaiting to be transmitted, such file comprising:

   a- a first sector (A) with the following functional operating codes with a FIFO organisation of the I/O accesses:

      i. control (1) from a computer (24) to a serial peripheral unit (21), the control (1) being comprised in a first sub-sector of the sector (A),
      ii. response to the control (4) from a serial peripheral unit (21) to a computer (24), the response to the control (4) being comprised in a fourth sub-sector of the sector (A),
      iii. pointer to the sector (2) being read by the computer (24), the pointer to the sector (2) being comprised in a second sub-sector of the sector (A),
      iv. pointer to the point (3) being read by the computer (24), the pointer to the point (3) being comprised in a third sub-sector of the sector (A),
      v. pointer to the sector (5) being written by the serial peripheral unit (21), the pointer to the sector (5) being comprised in a fifth sub-sector of the sector (A),
      vi. pointer to the point (6) being written by the serial peripheral unit (21), the pointer to the point (6) being comprised in a sixth sub-sector of the sector (A) and

   b- a series of sectors (B, C, D…N) subsequent to the first configured having constant dimensions for the immediate access to the data contained therein.

2. Real time system for the two-directional memorisation and transmission of controls and data according to claim 1 characterised in that the virtualisation of the peripheral (21) which is interfaced through the USB drive functionalities is obtained within the same serial peripheral unit (21) for signature using, for managing the external memorisation support (22), the same microcontroller that manages the other functions of the serial peripheral unit, such as the acquisition of the track and the visualisation on the display.
3. Real time system for the two-directional memorisation and transmission of controls and data according to any of the preceding claims characterised in that the memory support (22) is constituted by a physical memory made of two distinct sections:
a- a block (38) obtained with a read-only ROM memory, with the MBR sectors, BOOT SECTOR, FAT and ROOT DIRECTORY written once and for all in said ROM memory, maintaining the external medium always as the same structure, the same list of files and the same allocation;
b- a series of DATA blocks (39), obtained with a write/read RAM memory, of the volatile type.
4. Real time system for the two-directional memorisation and transmission of controls and data according to the preceding claim characterised in that the read only memory (38), is obtained with a Flash memory, thus avoiding the possibility of rewriting, by permanently disabling the function of deleting the sectors in which it is arranged, thus operating with the functional mode equal to that of an ROM, writing on the memory, only once during production.
5. Real time system for the two-directional memorisation and transmission of controls and data according to any of the preceding claims characterised in that the FAT table of the memory support (22) is predisposed, only once during designing, so as to allocate said file in a linear manner on the entire RAM, the memory sectors being allocated in the RAM in a strictly increasing succession sequence.
6. Real time system for the two-directional memorisation and transmission of controls and data according to the preceding claim characterised by the linear allocation of the sectors into which the RAM memory is divided on the memory support (22) without using any file system manager, the microcontroller allowing direct access to any sector of the RAM, through the immediate addressing to the memory location obtained with the multiplication of the number of bytes occupied by each sector, with the sector number within the RAM and summing the offset regarding the entry point.

7. Real time method for the two-directional memorisation and transmission of controls and data based on a Hardware system according to the preceding claims characterised in that it comprises the following operating steps regarding the acquisition process:

a) the digitiser serial peripheral unit (21) predisposes the sending of the data to be acquired in input to a FIFO queue (25) in the external medium (22) through:

a-1) the configuration of only one file constituted as a linear sequential succession of data, in sectors of constant dimensions, which can be shared, between the serial peripheral unit (21) and the processor (24), both of which can be parallel, read and write, on said file,

a-2) the insertion in the first sector of such file, for the organisation of the FIFO queue within the file, of the following operating codes:

i. control (1) from the computer (24) to the serial peripheral unit (21), the control (1) being comprised in the first sub-sector of the sector (A),

ii. response to the control (4) from the serial peripheral unit (21) to the computer (24), the response to the control (4) being comprised in the fourth sub-sector of the sector (A),

iii. pointer to the sector (2) being read by the computer (24), the pointer to the sector (2) being comprised in the second sub-sector of the sector (A),

iv. pointer to the point (3) being read by the computer (24), the pointer to the point (3) being comprised in the third sub-sector of the sector (A),

v. pointer to the sector (5) being written by the serial peripheral unit (21), the pointer to the sector (5) being comprised in the fifth sub-sector of the sector (A),

vi. pointer to the point (6) being written by the serial peripheral unit (21), the pointer to the point (6) being comprised in the the sixth sub-sector of the sector (A),

b) the processor (24) reads the data from the FIFO (25) as the latter is acquired from the output of the peripheral unit (21), and visualises it on the display with the sole delay given by the computer memory support communication, without delays attributable to an acquisition process based on the entire duration of the input on the peripheral (21), the access to the sectors of the file (B, C, …N) from the second to the last configured to contain the data of the points detected by the peripheral unit (21) occurring instantly.

8. Real time method for two-directional memorisation and transmission of controls and data according to any of the preceding claims characterised in that in order to activate the digital data detection operations:

I- the processor (24) writes the relative control as a byte in the position of the first sub-sector sector (A);

II- the serial peripheral unit (21), given that it is inoperative, continuously reads such first sub-sector (1) of sector (A) as soon as it sees the control introduced into said first position start acquiring the data in input and communicates the acceptation of the control by writing the response, in form of a byte, in the position (4) of the fourth sub-sector of sector (A);

III- parallel in position of the second sub-sector (2) of sector (A) and in position (5) of the fifth sub-sector of sector (A) it writes the number of the first data sector of the memory external medium and activates position (3) in the third sub-sector of sector (A) and position (6) in the sixth sub-sector of the sector (A);

IV- the processor (24) sees the response to the control in position (4)) of the fourth sub-sector of sector (A) and predisposes to visualise the track that shall be fixed – by the user – and acquired;

V- the serial peripheral unit (21) acquires the points of the track and progressively inserts each one of them in the sector addressed by the sector pointer (5) of the fifth sub-sector of sector (A) and by the point pointer (6) of the sixth sub-sector of sector (A);

VI- for each point provided in input, the peripheral unit increases the point pointer (6) in the sixth sub-sector of sector (A) and, when it exceeds the number of points that can be contained in a sector, it zeroes the point pointer (6) in the sixth sub-sector of sector (A) and increases the sector pointer (5) in the fifth sub-sector of sector (A) by one unit;

VII- if the sector pointer exceeds the last sector of the external memorisation support, the serial peripheral unit (21) returns it to the initial value, thus reutilising the first free sector which in the meanwhile shall already have been read by the computer,

and in that while the serial peripheral unit (21) acquires the points in input with the I-VII sequence, actually parallel from the processor (24) the following operating steps are performed:

a- the processor (24) sees that the pointer (6)) in the sixth sub-sector of the sector (A) or the pointer (5) in the fifth sub-sector of the sector (A) are different from pointer (3) in the third sub-sector of the sector (A) and from pointer (2) in the second sub-sector of the sector (A), and thus detects that there are points ready to be read;

b- the processor (24) reads each point from the external memory support, in the operating memory thereof and increases the pointer (3) in the third sub-sector of sector (A);

c- should the pointer (3) of the third sub-sector of sector (A) exceed the number of points per sector, the processor (24) zeroes the pointer (3) in the third sub-sector of the sector (A) and increases the pointer (2) in the second sub-sector of the sector (A);

d- the processor stops as soon as all points generated by the serial peripheral unit have been read, this condition occurring when the increased pointer (3) in the third sub-sector of the sector (A) reaches the same value of the pointer (6) in the sixth sub-sector of the sector (A) and the pointer (2) in the second sub-sector of the sector (A) reaches the same value of the pointer (5) in the fifth sub-sector of the sector (A);

the correctness of the performance of the data transfer operation not depending on the exact time sequence of the events, in that the serial peripheral unit (21) only writes on pointer (5) in the fifth sub-sector of the sector (A) and pointer (6) in the sixth sub-sector of the sector (A) while the processor (24) only writes on pointer (2) in the second sub-sector of the sector (A) and pointer (3) in the third sub-sector of the sector (A).

9. Real time method for two-directional memorisation and transmission of controls and data according to any of the preceding claims characterised in that should the acquisition by the processor (24) slow or cease for a given period of time, the serial peripheral unit (21) continues writing the data in the file and updating the pointers, recovering the delay and acquiring the points suspended in the FIFO, when the processor becomes available again.

10. Real time method for two-directional memorisation and transmission of controls and data according to the preceding claims characterised in that according to the limit functional conditions:

    i. FIFO queue empty: when the pointer (2) in the second sub-sector of the sector (A) = pointer (5) in the fifth sub-sector of the sector (A), and pointer (3) in the third sub-sector of the sector (A) = pointer (6) in the sixth sub-sector of the sector (A)

    ii. FIFO queue full: when the pointer (5) in the fifth sub-sector of the sector (A) = pointer (2) in the second sub-sector of the sector (A), less than 1,

upon reaching the end of the file, the serial peripheral unit (21) resumes writing from the second sector thus re-utilising the previously used area, as long as it has been freed from the processor in the meanwhile.

11. Real time method for two-directional memorisation and transmission of controls and data according to the preceding claims characterised in that it provides the ciphering of the data before the transmission thereof, obtaining it with a symmetric algorithm, point per point of the track in input, at the same point when every point of the track, just previously acquired, is written in the RAM which forms the sectors of the data exchange disc, the ciphering key being renewed at each signature operation through the dedicated cryptography protocol, by performing the following operating steps:

a- according to a dedicated configuration of the operating codes the processor (24) writes - in the position (1) of the first sector of the disc - the byte the key exchange control, and its random key (Ka) in the subsequent bytes,

b- the serial peripheral unit (21) responds by inserting, in the byte at position (4) of the fourth sub-sector of the sector (A), the affirmative response to the received control, and inserting its random key (Kb) subsequently;

c- subsequently the two devices immediately perform the operations provided by the cryptography algorithm generating the symmetric cryptography common key which is used in the subsequent signature operation.

12. Real time method for two-directional memorisation and transmission of controls and data according to any of the preceding claims characterised in that the functionality of visualising the images on the I/O peripheral (21) provides for a dedicated configuration of the operating codes with the following operating steps:

a- the division of the image data into blocks of dimension equivalent to a sector of the disc, the processor inserting - in the first position - the image visualisation control byte and - in the subsequent positions - the coordinates on the screen (X_1,Y_1) and (X_2,Y_2) the two upper right lower left angles of the image to be displayed, thus the counter (Bw) of the written blocks and the counter (Br) of the read blocks is zeroed;

b- the writing - by the serial peripheral unit (21) - of the response to the control in the relative position (2) of the second sub-sector of the sector (A), the processor starting to write - in the data sectors - the blocks into which it divided the image, for each written block increasing the counter of the written blocks (Bw), wherein the serial peripheral unit seeing that the counter of the read blocks (Br) is different from the counter of the written blocks (Bw) and starting to read the data blocks and transfer them to the display, increasing the counter of the read blocks (Br) at each counter, and continuing until the counter of the read blocks (Br) becomes equal to the counter of the written blocks (Bw).

c- the serial peripheral unit, upon receiving all the data required to complete the image, writing the position pixels (X_2,Y_2), understands that the end of transmission of the image has been reached and removes its response from the position (2) of the first sector, the processor in turn detecting that the transmission has been successful.

13. Real time method for two-directional memorisation and transmission of controls and data according to any of the preceding claims characterised in that the allocation of said consecutive blocks corresponding to the sectors of the disc operates according to a circular FIFO queue, the current number of the sector being obtained starting from the current number of the block as

Sector = 2 + Block mod Ns

Ns being the number of sectors of the disc available for the data; and the module operation automatically obtaining the return to the first sector when the pointer to the block exceeds the termination of the external memory support, considering the limit conditions of:

i. buffer empty, counter of the read blocks (Br)= counter of the written blocks (Bw)
ii. buffer full, counter of the written blocks (Bw) - counter of the read blocks (Br)=Ns,

hence respectively:

a- with the buffer empty, the serial peripheral unit ceases reading;

b- with the buffer full, the processor ceases writing until the serial peripheral unit clears the space.