PAC-MAN

A Project Report

Submitted By

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NATIONAL INSTITUTE OF TECHNOLOGY
KARNATAKA
SURATHKAL, MANGALORE – 575025**

ABSTRACT

Pac-man is a classic two player arcade game that was originally designed for computer based platforms and was adapted to be played on a 16 X 16 RGB led board as a project in Technites.

The players are supposed to traverse the maze and eat as much food as possible in the given time in order to win the game. Inputs can be taken from microcontrollers using UART or even a keyboard can be used for simplicity. Even dedicated controller pads can be made for the purpose. The brain of the organization is MSP430G2553 micro controller driving the 6 TLC5916 8 bit current sinks and the TLC59213 current sources along with 74HC595 8 bit shift registers. The entire configuration is common anode, that is, common anode RGB LEDs were used. Three pairs of TLC5916 were used to sink currents from the 16 columns for the three colors RGB. The entire board works on the concept of multiplexing where the rows are multiplexed sequentially at a rate fast enough to cause persistence of vision effect making the entire frame appear still whereas the micro-controller is pumping data at a very fast rate. The entire board is powered using 12V, 2A wall adapter. The driver circuit has several 7805 linear voltage regulators connected in parallel to power the TLC5916s, TLC59213s and the 74HC595 shift registers. A 3.3 volt regulator is also used to power the MSP430G2553 microcontroller. The LED board consists of 256 RGB LEDs with the anodes of all the LEDs in a row connected in common since it is common anode connection. This way we get 16 common anodes that are connected to the outputs of TLC59213 current source drivers. The cathodes of all the respective colors are connected together in columns. This way 16 cathodes of each color give a total of 48 cathodes that is connected to the TLC5916 current sink drivers. There are a total of 6 TLC5916 cascaded together to form a 48 bit register to connect to the common cathodes. On the source sides two TLC59213s are cascaded along with 74HC595 to make 16 bit registers to connect to the 16 common anodes. The latches of all the TLC5916s are connected together and so is done with the clock.

In the same fashion the clocks and latches of 74HC595 and TLC59213 are connected together. The MSP cycles through the rows displaying individual rows with all the three colors at a very fast rate to achieve POV effect. The processing is done on a laptop in a C++ program that sends data of the current frame to the microcontroller over UART serially which is stored by the controller temporarily and then written to the LED matrix. For serial communication, the serial library of C++ was used. To add little complexity in the game certain obstacle walls made up of LED strips are added to the board and defined in the C code. Movement of players across these boundaries is not allowed. There are variables to grab the movement of players and accordingly manipulate the LED matrix that is to be sent to the microcontroller. Variables for recording the scores of both players are also defined in the code.

Initialization:

The two players are initialized to be on opposite corners of the matrix in Red and Blue while all the other LEDs were initialzed Green to indicate food.

Game-Play:

The players use controllers to move their markers on the board and each as much food possible in the given time. Players cannot eat each other and cannot go out of boundaries.

Winner:

The game continues till the timer times out and the player who eats the most number of food LEDs is the winner.

BLOCK DIAGRAM OF PAC-MAN

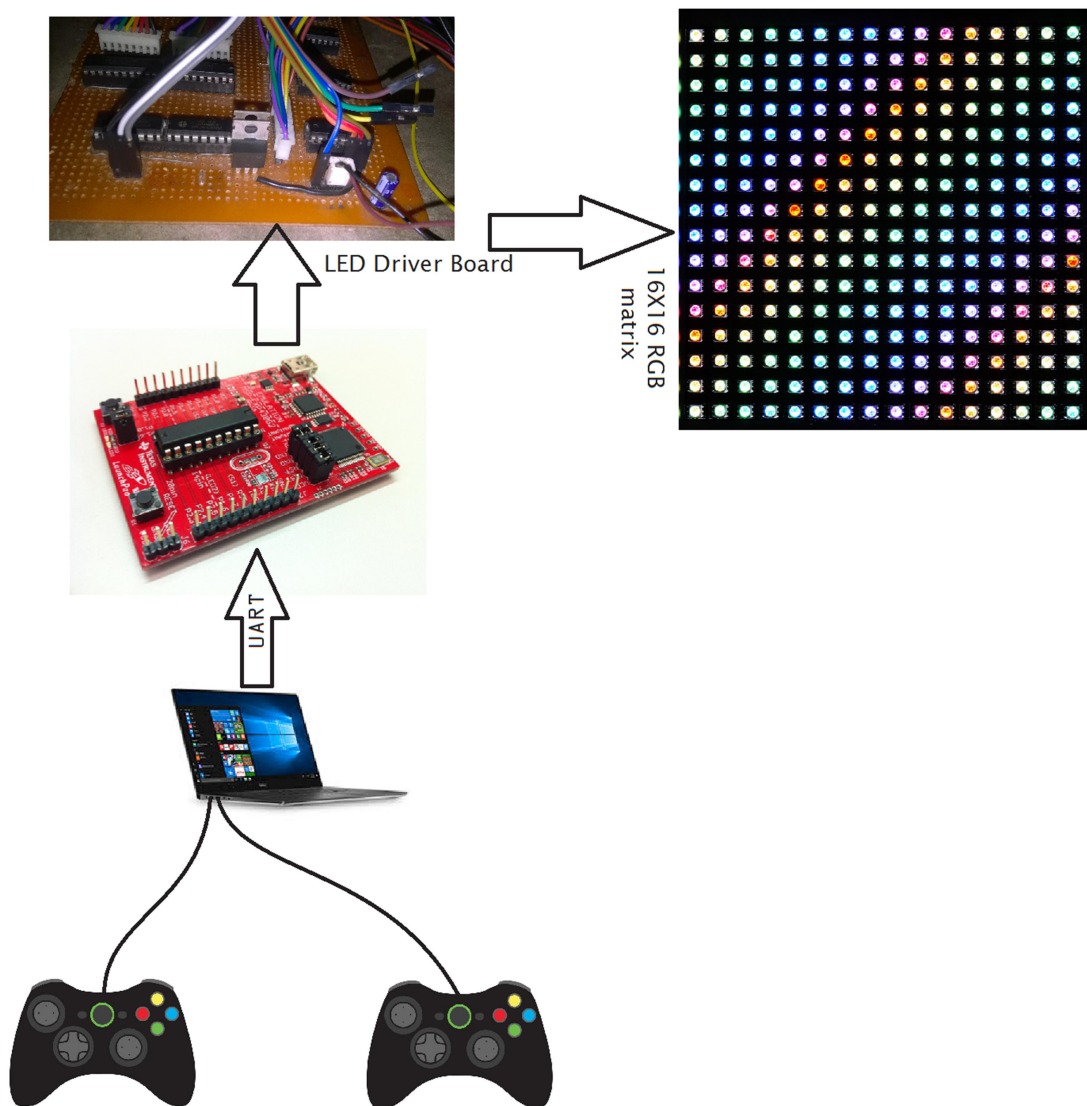LED Driver Board

16X16 RGB matrix

UART

Fig. Block Diagram of Pac Man

COMPONENTS NEEDED

1. Plywood board X 1

2. RGB common anode leds X 256

3. Lot of ribbon cables and single strand wire

4. 8 female header connectors

5. Vero board X 1

6. TLC 5916 X 6

7. At-least 5, 7805 ICs

8. 3.3 volt regulator

9. MSP430G2553

10. IC sockets

11. TLC 59213 X 2

12. 74HC595 X 2

13. 1k resistors

14. Lot of solder wire and solder gun

15. Glue gun

16. MSP Launch Pad X 1

SOFTWARES NEEDED

1. Any standard C++ compiler with serial library

2. Code Composer Studio (CCS) for programming MSP
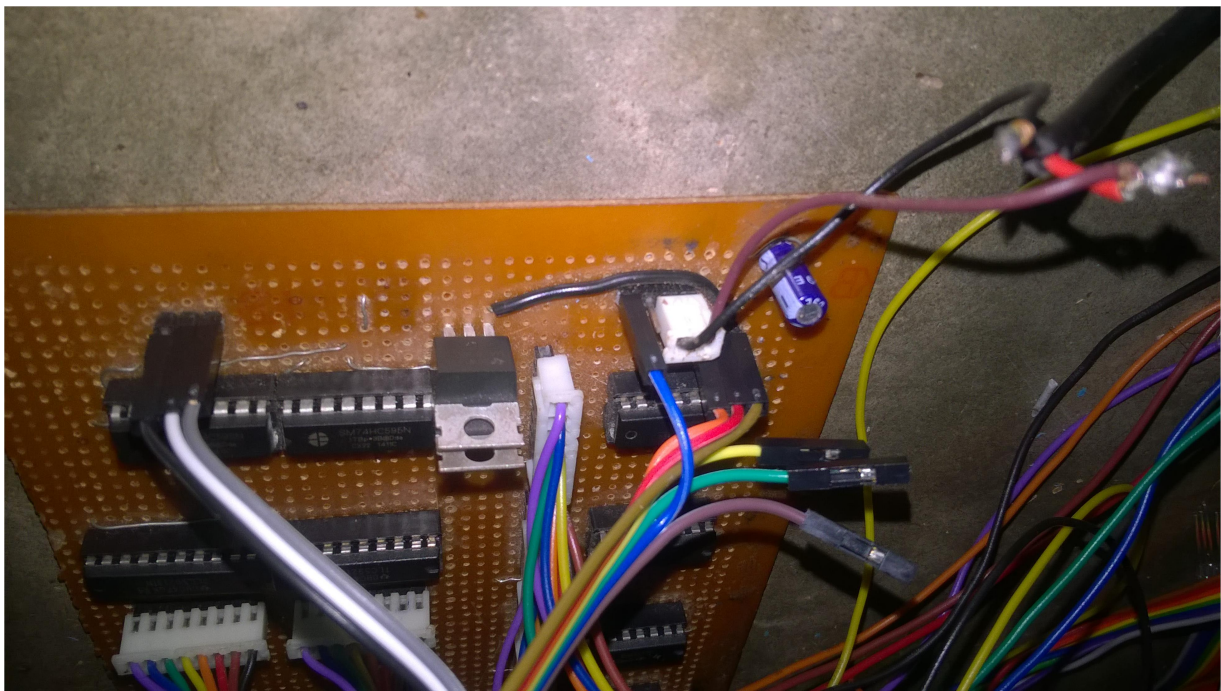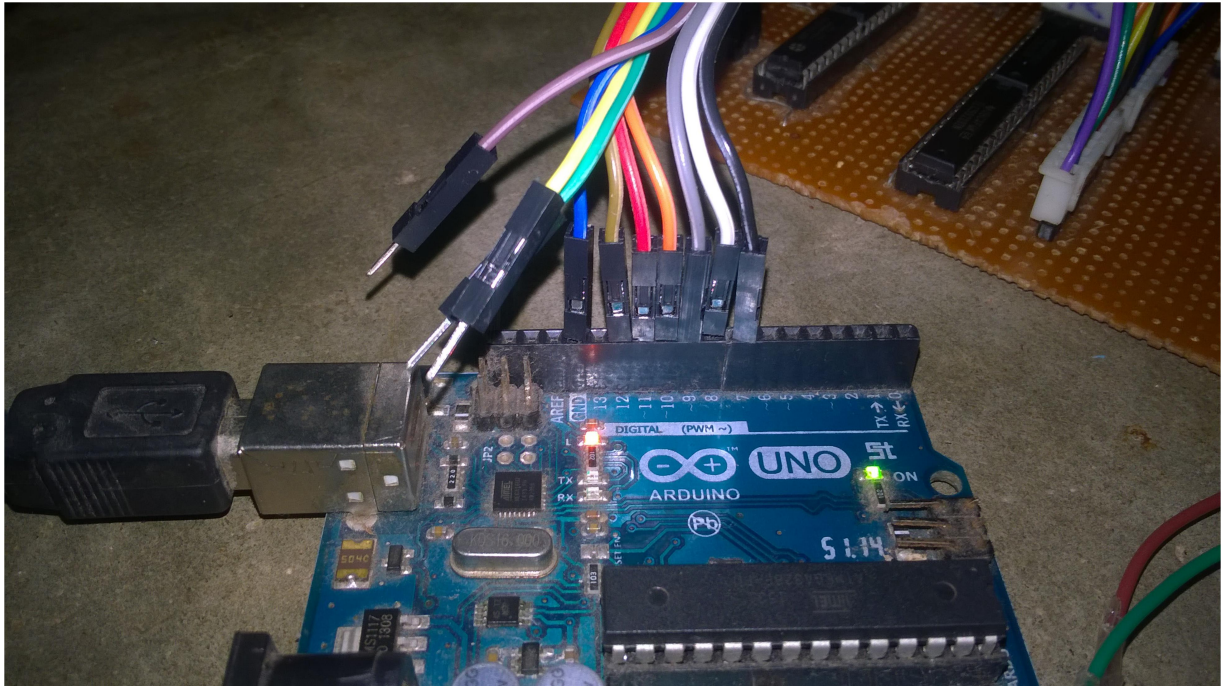
PROBLEMS FACED

1. Debugging is very cumbersome manually and a lot of data is to be recorded while debugging.

2. The data transfer from one 74HC595 to the next one is slower than the latch of TLC59213 because of which 9th row doesn't work properly many times. (To overcome the above problem, latch the 74HC595 twice).

3. MSP code has some bugs that need to be addressed, as it does not give expected results. Arduino had to be substituted to speed up things and debug the board.

4. The LED solder joints are very fragile and occasionally short with each other to produce some weird patterns.

5. The circuit draws a lot of current continuously because of which the linear Voltage regulators heat up significantly.

6. The C++ code running the MSP is very complex in nature.

7. The baud rate at which current C program transfers data, 9600 is considerably slow as compared to the amount of data being sent over UART.

FUTURE WORK

1. Solve the problem of delay in data transfer from one 74HC595 to the other

 so that double latching is not required and the Micro-controller can run at

 a faster rate.

2. Dedicated controllers can be made for taking inputs to make the game better.

3. There is a lack of documentation on the serial library and how it is used in this

 project which needs to be addressed to.

4. More permanent soldering is to be done on the LED board to ensure stable performance.

5. Heatsinks on the linear regulators would be very good for dissipiating the heat.

CONCLUSION

The project can be successful provided the C++ code receives proper documentation. Right now it lacks documentation on the MSP code as well. There is a need of reverse engineering the code to make it more understandable. Being a classic arcade game, it will be very good to have it in next year's Engineer for the visitors to enjoy and have a great time.