Gesture and Character Tracing Interactive Lecture Board

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***Abstract*— Technology is playing a very vital role in human life. New technological trends are the reflections of the demands and needs of the society. Today we have solved many social problems using technology. It has completely transformed many fields like transportation, education, space, industries etc and helped for the improvement of the society.**

The work presented here in this paper has a potential to bring new trend in education sector as far as teaching is concerned. The work presented here is an Interactive E learning experience which focuses mainly on higher education sectors.

Gesture and Character Tracing Interactive Lecture Board is a lecture board where a professor can use it to deliver a lecture in the regular traditional chalk and board method but the board has an internal electronic circuitry and a processor board which can understand what the professor is writing and respond to it by displaying it in the board itself. The board is a mini computer which can support many software like MATLAB, Multisim, CAD, PSpice, jGrasp etc which are used by engineers frequently. The Board also has an internet connection which can help the professor and students to extract the information from the web during the lecture on the board.

***Keywords*— Hand Gesture Tracing, Character and speech recognition. Symbolic evaluation engine [1], Segmented Board analysing algorithm, Interactive lecture board, On board web access.**

I. INTRODUCTION

The work basically focuses on providing quality education in the developing and underdeveloped countries with least possible expenses as a solution. Gesture and Character Tracing Interactive Lecture Board tries to provide a solution.

The board looks just like our conventional chalk and board arrangements but it will be exposed to many sensors which can trace the movement of the professor. Sensors are used to trace the hand movement and speech analyser to recognise the professor. The professor can deliver the lecture in the class in regular way; he can use the board to write the subject materials. The on board processor which is embedded on the board takes all the inputs from the sensors and it also traces the hand movements. The algorithm which we have developed will understand the written characters and diagrams and it can give solution to the problem then and there itself on the board.

The board has also been provided with internet access which can help the students and professor to refer useful websites like Wikipedia or how stuff works etc to clarify the doubts in the class.

The circuits and peripherals used in this are quite cheap which helps the local technical colleges to afford theses boards to provide quality technical education.

II. DATA ACCRETION

To have an accurate interfacing system one need to have a precise database of all the variable parameters.

A. Output from sensors

The output from the sensor will be dumped in the database which will be used by the processor to locate the location of the human in front of the board. To achieve this we have used LDR [2] as sensors. This determines the location of the human

in front of the board. The data from the sensors will be accreted in the database for the future use. If the data stored in the data base is found to be of no use that that will be deleted. All these process will be done by the intuitive algorithm coded in the embedded board.

To trace the movement of the hands Infrared sensors have been used. The primary reason of using Infrared sensors is it makes the system less expensive. Ultrasound sensors can also be used for mapping the location [3] the hand on the board. Implementing Ultrasound Systems are quite easy and it gives quite accurate results. However in our experiments we have used infrared sensors to map the locations.

Other data acquisition systems will be microphone to implement speech recognition system and camera to implement image processing to give much realistic interfacing actions.

Figure 1 shows the implementation of sensors.

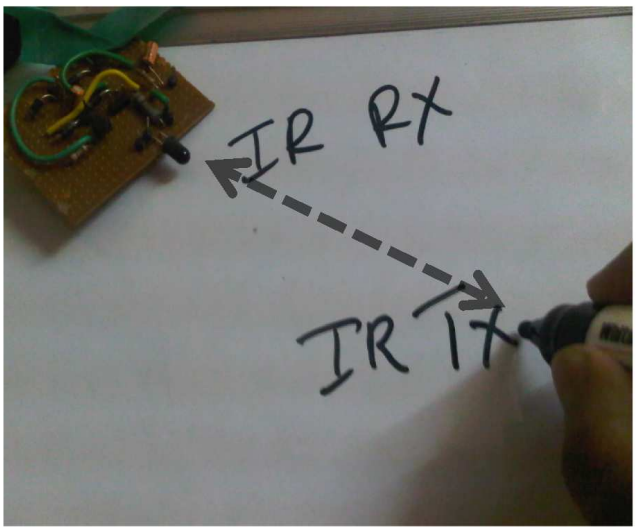

Figure 1. Hand movement tracing

To locate the position of the human in front of the lecture board LDRs will be mounted on the floor in front the board. When the person in front the board places his foot on the LDR he will be blocking the light falling on the LDR and this we can have the location on the human in front of the board. This also will be the input to the processing board.

B. Data analysis of the accreted data in the data base

Once all the data gets acquired in the system the system jumps to analysis algorithm. Here in this stage all the data with respect to position, hand movement, speech and image will be meticulously analysed and a sensible result will be generated and displayed on the board. The result could be the characters based on the hand movement or words form the speech or it could also be some image or data from the internet.

We will be implementing Symbolic evaluation engine to understand what is being written on the board.

The algorithm is designed in such a way is undergoes a systemic procedure. It knows what data has to be acquired at what time from which sensor.

This data can also form as inputs to software like MATLAB, MULTISIM [4], CAD etc which results in an real time interaction with this software packages.

Some simple examples would be, writing a graph on board and giving a 3 dimensional rotational effect using MATLAB just by using simple hand gestures.

The data can linked with software packages like P spice to solve electronics circuits.

III. SEGMENTED BOARD ANALYSIS

Another method to cut down the cost and increase the precision of the position analysis is by segmenting the board.

The board will be segmented by m x n matrix. Where m corresponds to the rows on the board on n corresponds to the columns on the board.

Each segment will be associated with a make and break contact a sort of switch which connects the circuit and delivers a voltage when touched.

So when a person writes on a lecture board he is making a series of make and breaks of circuits which will be traced by the processor. Say for instance a person touches 5^{th} row 7^{th} column segment, now this line will be held high for that instance. This line will be fed to an input of the demultiplexer[5]. Similarly all the m x n segments data line will be fed to the demultiplexer input. The

select line of the demultiplexer is fed to a counter[6] which runs at a high speed.

For m x n segments there will be m x n data lines as input to the demultiplexer so there will be

Log $_2$ (m x n) select lines. All theses select lines are controlled by a synchronous counter. So at the end of the stage the output from the demux will be time varying the data present in the m x n segments of the board. This can be called as data sweeping on the board where we can actually fetch the segments status write from 1 x 1 to m x n systematically.

IV. CHARACTER RECOGNISING ALGORITHM

Suppose the counter can help the demux to fetch the data by sweeping the board in say 3 millisecond

That means to fetch data from 1 x 1 to m x n the counter takes 3 ms. On the other hand the code which will be burned into the processor will have an array of m x n dimension accessed by a loop.

A pseudo C code is written below to show the fetching operation.

```
  //Pseudo Code
  #include<stdio.h>
  #include<conio.h>
void sendpulse(void);
void displaycharacter(int);
typedef enum {false ,true } bool;
bool fetchdata(int,int);

void main()

{
bool mat[6][6];
int m,n,value;
int tap[6][6];

while(Interrupt=0)
{
for(m=0;m<6;m++)
{

  for(n=0;n<6;n++)
  {
  sendpulse();
  mat[m][n]=fetchdata(m,n);
  if(mat[m][n]==1){tap[m][n]++;}
  }
}
}
for(m=0;m<6;m++)
  {
  for(n=0;n<6,n++)
  {value=value+(tap[m][n]*2^(mat[m][n]));}
  }
displaycharacter(value);
}
```

The function sendpulse() will send a pulse to the counter to change the state and thus data to the select line of the demux will be changed.

By knowing the state of the counter the logical data can be diverted to the corresponding location on the array mat.

0	0	0	0	0	0
0	1	1	0	1	0
0	1	0	1	1	0
0	1	0	0	1	0
0	1	0	0	1	0
0	1	0	0	1	0

Figure 2. segmented board indicating its segment`s status for letter ‘N’

The above Figure 2 shows the status of m x n matrix for the letter ‘N’ written on the board.

Say for instance mat[3][2] is holding ‘1’, It implies that the segment on the board corresponding to row 3 and column 2 was touched.

The array tap[m][n] keeps the count of how many times the segment was touched, say if tap[3][2] is 3 that means that segment was touched thrice.

After obtaining the data a summation will be done with (number of tap X 2 power logical state of the segment)

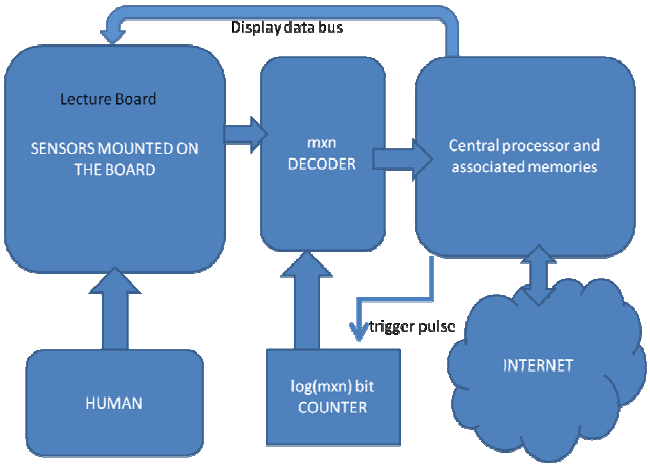

Figure 3. data flow diagram of the unit

Figure 3 delineates the data flow through the system.

The final result after solving

Σ(taps*2^mat[m][n])

The result will be a unique value for each individual character and thus finally we can send this character to the display board.

V. Conclusions

The paper aimed to bring a new trend in the technology with reference to education sector.

The work presented in this paper can be implemented in technical colleges at decent expenses and can provide a quality education.

The board provided a platform to merge many software and provided an intuitive interaction techniques with those software to the students and professors by preserving the traditional chalk and board conventions.

References

[1] Symbolic evaluation engine for high-performance simulations, United States Patent 7415395.

[2] http://www.biltek.tubitak.gov.tr/gelisim/elektronik/dosyalar/40/LDR_NSL19_M51.pdf

[3] http://kom.aau.dk/group/09gr723/gruppe1032_CD/P10/hardware/datasheets/ozkan2004.pdf

[4] http://www.ni.com/multisim

[5] The art of electronics, Paul Horowitz and Winfield Hill, 2nd edition, Pg 143,496f.

[6] An Illustrative Approach to Logical Design, R D Sudhaker Samuel, Pg 297.