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Persistence of Vision for Alphabet Recognition

Technology is growing by the day, and its advancement in the field of visual display has been phenomenal as well. This paper deals with one of several phenomena dealing with visual display called the Persistence of Vision Display (POV). Persistence of vision refers to the phenomenon of the human eye in which the afterimage exists for a brief time (10 ms). A POV display uses this same phenomenon by spinning a one dimensional array of LEDs through two dimensional space at such a speed that a two dimensional cylindrical display is visible. This movement is achieved by placing the LEDs on a motor shaft. The rotational speed is so maintained that the human eye perceives a two dimensional image. Rather than display a monotonous stream of letters we have established a link between an alphabet recognition system and the display system using a ZigBee. At the transmitter end, i.e., the alphabet recognition end, a set of four switches are placed which aid in the incrementing and decrementing of the letters of the alphabet, incrementing the cursor to the next position and sending the set string of data through ZigBee. The transmitting section uses an AT89S52 for recognizing the alphabet and transmitting it. The receiver section of ZigBee receives this string of data and displays it on the rotating LEDs. On the receiver end we use an AT89C2051 microcontroller which has an inbuilt LED driver to reduce the weight and space on the module.

Key Words : Persistence, Vision, ZigBee, Microcontroller, One and two dimensional image.

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(1) Introduction :

The core idea of the project revolves around the single phenomenon of persistence of vision. Persistence of vision is a phenomenon pertaining to the ability of the eye, where the afterimage seen continues to exist in the retina for a certain period of time (approx. 10ms). Many people have proposed methods using multiplexers, shifters, timers, microcontrollers, etc. to exhibit this phenomenon. This work enables a display of text of desired length at a low cost and high efficiency.

In the paper [1] a PIC microcontroller is used along with latches which are used for multiplexing the signal. The display is obtained on an LED array. This type of display has the option of showcasing text or a clock based on choice. The text to be showcased is the same as the text that has been preprogrammed in the microcontroller.

In paper [2] a rotating display is created using an AT89C52 microcontroller along with an RTC (real time clock). This display deals with the showcasing of time and date using the RTC. RTCs are usually used in mobiles or computers or in instruments where a high accuracy of time keeping is required. So, in this display the RTC is used to keep the time and day up-to-date. Every time the display is turned on the date and time at that particular moment is shown. This is achieved by a single column of 8 LEDs

working on the principle of persistence of vision.

The Propeller Clock [3] uses the concept of persistence of vision to display a live clock. The paper makes a case for creating a circular display instead of the conventional cylindrical display. An optocoupler is used to provide interrupts to the microcontroller. An AT89C2051 microcontroller is used to reduce weight of the POV display.

In paper [4], Persistence of vision control is achieved using an Arduino microcontroller. This microcontroller is faster, performs better and is more efficient. The whole kit works with an android operating system. Instead of using the conventional single color LEDs, an RGB LED is used here, which emits three colors. The display of the message is governed by any android device connected to the Arduino board.

The spinning LED display using radio frequency takes the concept of rotating displays using a single column of LEDs a step further. In paper [5], the users are operating a preprogrammed AT89S52 microcontroller, i.e., the message to be displayed is already dumped into the microcontroller. They also have the option of changing the message by simply reprogramming the microcontroller or establishing a communication link between the display and a PC using RF frequencies. This link enables the user to send a stream of data to be displayed from the PC.

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(2) Proposed Work :

Energy crisis is one of the most acute problems concerning the world today. Saving power should be of the highest priority on everyone's agenda. But the way the world is growing, it is encouraging the rise of new industries and entertainment and amusement zones. These industries and amusement parks require the installation of display units which consume a lot of power. This work shows how by using a single column of LEDs to make display units, we can reduce our increasing consumption of power. These units can display any message using transmitter boards.

(3) Components :

The following are the components used in this system:

(I) Microcontroller :

This system uses two microcontrollers:

(i) **AT89S52** : The heart of our transmitter section is the AT89S52. The 8 bit microcontroller has 8K of in-system programmable flash memory and 256 bytes of RAM. The microcontroller has 32 I/O lines. The microcontroller also houses a full duplex serial communication port and a set of three 16bit timers/counters. The microcontroller works on two modes, an idle mode and a power down mode.

(ii) **AT89C2051** : In our receiver section we are using the AT89C2051 microcontroller. This 8 bit microcontroller has 2K of in-system programmable flash memory and 128x8 bytes of RAM. The microcontroller has 15 I/O lines. It has a programmable serial communication port. The microcontroller has direct LED drive output lines.

(II) Liquid Crystal Display (LCD) :

The LCD connected to the microcontroller is a 16x2 display. With the LCD, if an 8bit data bus is used, then the LCD will require 11 data lines (3 control lines and 8 lines for the data bus). These three control lines are referred to as EN (Enable), RS (Register select), and RW (Read/Write). The Enable pin is used to tell the LCD that we are sending the data. If the Register Select pin is low it means that the data is treated as a command and if it is high then the data sent is text. If the Read/Write pin is low it means that the data is written and if it is high, the data is read, provided the register select pin is high.

(III) ZigBee :

ZigBee is a transceiver module which communicates using the RF frequencies. It transmits and receives data at 9600 baud rates from any CMOS/TTL source. It works in half duplex mode, i.e., the data can be sent only in one direction at a time. ZigBee is a low-power and low-cost communication module.

(IV) MAX 232 :

MAX 232 chips are used to convert the given voltages to RS 232 communication standards. MAX 232 is also referred to as a line driver. It works on the principle of charge pumping. This IC is the best at noise rejection and is also very reliable against discharges and short circuits.

(4) Implementation :

The block diagram 1 shows the transmitter section of

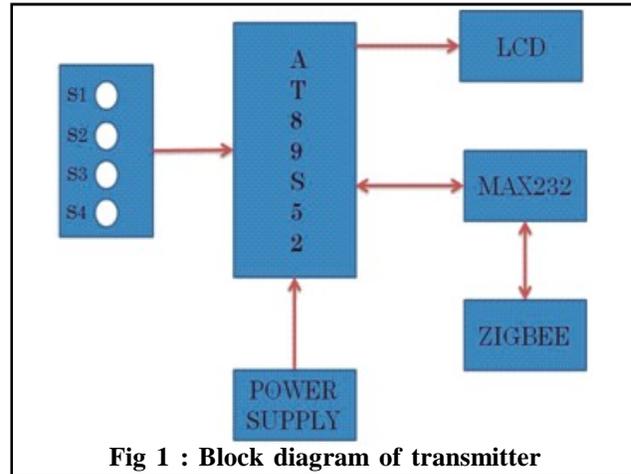


Fig 1 : Block diagram of transmitter

the module. The heart of this transmitter circuit is the AT89S52 microcontroller. In the transmitter section there are four switches S1, S2, S3, S4. S1 is used for incrementing the alphabet, S2 for decrementing the alphabet, S3 is used for incrementing the cursor to the next position, and S4 is used for transmitting the data serially using ZigBee. The desired string is typed using the switches (S1, S2, and S3). The LCD connected to the module will help the user see what has been typed. Once the desired string has been typed it can be transmitted by pressing S4. Max 232 now converts the string into RS 232 compatible standards and transmits the typed text to the receiver section with the help of ZigBee.

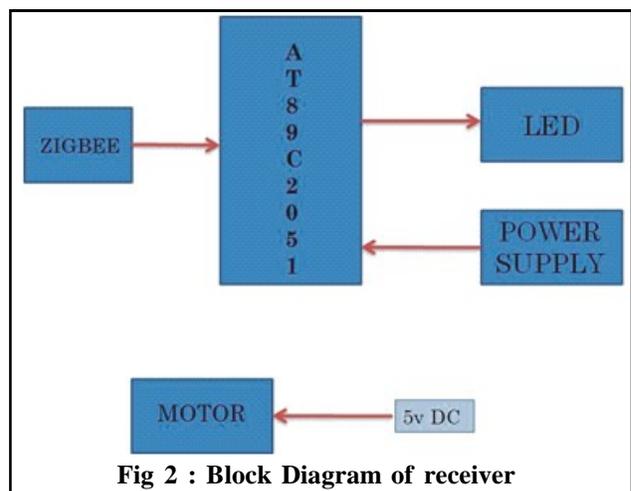


Fig 2 : Block Diagram of receiver

The above block diagram shows the receiver section of the module. The heart of the receiver circuit is the AT89C2051 microcontroller. This microcontroller is used because it has the capability of directly driving the LEDs, therefore LED driver chips need not be used. This reduces the weight of the module. The ZigBee on the receiver section receives the data and sends it to the microcontroller. Based on the data received, the microcontroller either switches the LED on or off for the specified period of time. This setup is mounted on a motor. When the motor is switched on, the module starts rotating at a calculated number of rotations per minute. The single column of LEDs rotating in a cylindrical column displays the entered string.

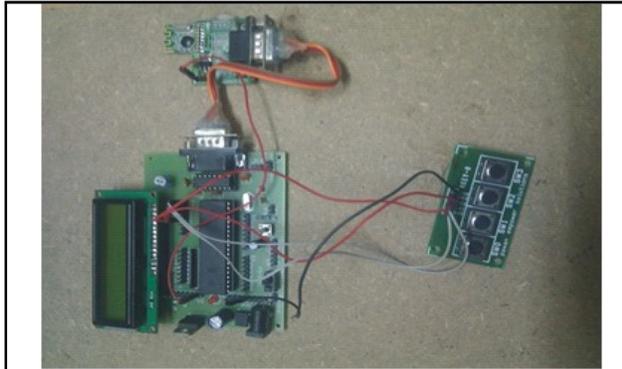


Fig 3 : Prototype development board (Transmitter)

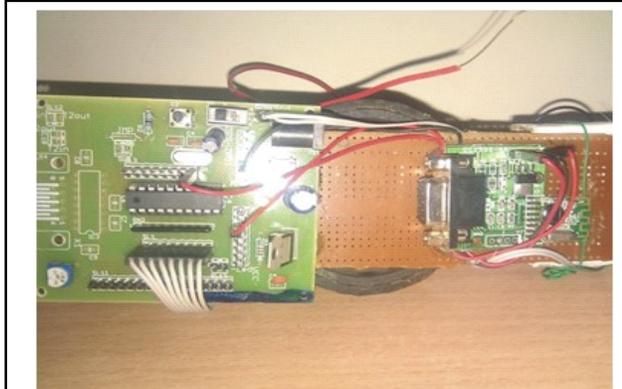


Fig 4: Prototype development board (Receiver) top view



Fig 5 : Prototype development board (Receiver) Front view

(5) Software :

Initially, in the transmitter section, the LCD and serial ports are reset for initialization. A message “WELCOME” is displayed on the LCD screen. The microcontroller then redirects the LCD to a blank screen which displays a cursor and the letter 'A'. The LCD then awaits the next command. If S1 (switch 1) is pressed on the kit an increment of characters occurs until the desired character is obtained. Once the desired character is obtained, S3 (Switch 3) should be pressed for the cursor to move to the next position on the LCD. In the same manner S2 (switch 2) is used to decrement the alphabet count. Once the desired string of data is set on the LCD, S4 (switch 4) should be pressed which transmits the string of data using a ZigBee.

In the receiver section, initially the serial and timer registers are reset. The ports to which the LEDs are connected are also reset. By doing this the serial timer registers and the LED ports are initialized. The microcontroller now checks if there is any data being received at the ZigBee. If there is data being received, the microcontroller checks which character is being received. Based on the character received an appropriate time delay is created for the LED to be ON or OFF. If there is no data being received a preprogrammed message saying “HELLO” is displayed on the LED array.

(6) Applications : The advantage of the present work is that it consumes much less power than the display units in use in the market now. This work enables the user to display a desired string rather than a monotonous string. This work is also light to carry around. The user doesn't require a PC or a programmer to reframe the display message. All that the user needs is a transmitter board.

Conclusion : Energy efficiency is a growing demand in today's world and so is modernization with technology. This work combines both by creating a user friendly display at low cost with high efficiency and low power consumption.

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An Empirical study on customer satisfaction towards three star hotels at Hyderabad

Customer satisfaction is an ambiguous and abstract concept and the actual manifestation of the state of satisfaction will vary from person to person and product/service to product/service. The state of satisfaction depends on a number of both psychological and physical variables which correlate with satisfaction behaviors such as return and recommend rate. The purpose of this study is to identify the most influencing factor that enhances the satisfaction level of the customers in star hotels at Hyderabad. The various factors that are taken to measure the customer satisfaction are (1) Reception (2) Rooms (3) Restaurant (4) Entertainment (5) Trips and (6) Location. Using statistical package for social science (SPSS) the following test are administered 1. Factor Analysis and 2. Multiple Regression. To check the reliability and validity of the data collected Cronbach's alpha test administered.

Key Words : Customer Satisfaction, Hospitality, Location, Restaurant

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Introduction :

Customer satisfaction is a business philosophy which tends to the creation of value for customers, anticipating and managing their expectations, and demonstrating ability and responsibility to satisfy their needs. Customer satisfaction is the outcome of customer's perception of the value received in a transaction, where value equals perceived service quality, compared to the value expected from transactions. Enterprises which are able to rapidly understand and satisfy customers' needs, make greater profits than those which fail to understand and satisfy them. Since the cost of attracting new customers is higher than the cost of retaining the existing ones, in order to be successful managers must concentrate on retaining existing customers implementing effective policies of customer satisfaction and loyalty. In this study the researcher wants to identify the most influencing factor that enhances the satisfaction level of the customers in star hotels at Hyderabad.

Review of Literature :

Gandolfo Dominici(2010) examined that, In order to be successful in the market it is not sufficient to attract new customers managers must concentrate on retaining existing customers implementing effective policies of customer satisfaction and loyalty. In hotel industry customer satisfaction is largely hooked upon quality of service. A management approach focused on customer satisfaction can improve customer loyalty, thus increasing the positive image of the touristic destination. Hence, exploring the

importance for customers of hotel attributes in hotel selection is indispensable. Research on the topic of guest satisfaction, which translates into the consideration of whether or not customers will return to a hotel or advise it to other tourists, is pivotal to the success of the hospitality business. Neglecting to pay attention to those hotel attributes considered most important by guests, may lead to negative evaluation of the hotel, thus restricting the chance of repeat patronage. Ivanka Avelini Holjevac (2009) one of the biggest contemporary challenges of management in service industries is providing and maintaining customer satisfaction. Service quality and customer satisfaction have increasingly been identified as key factors in the battle for competitive differentiation and customer retention.

Research Questions :

- (1) To identify the most influencing factor that enhances the satisfaction level of the customers.
- (2) To find out Hospitality and Comfortable Rooms can predict the overall satisfaction of customers

Methodology :

The study is a descriptive one. Primary data was collected by the researcher with the help of structured questionnaire administered to the customers who are residing in two leading three star hotels at Hyderabad. 103 customers from those hotels constitute the sample size. Fifteen questionnaires were distributed for the purpose of pre-testing the questionnaire's contents a complete questionnaire was developed based on the comments collected during the pre-testing period. Type of sampling

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method used was simple random sampling. Due to various reasons the hotel name is not being disclosed in this study. The various factors that are taken to measure the customer satisfaction are (1) Reception (2) Rooms (3) Restaurant (4) Entertainment (5) Trips and (6) Location.

Using statistical package for social science (SPSS) the following test were administered (1) Factor Analysis and (2) Multiple Regression.

Reliability Statistics :

An examination had been made from the reliability of the data to

Table 3 : Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.301	16.507	16.507	3.301	16.507	16.507	2.348	11.741	11.741
2	2.297	11.483	27.989	2.297	11.483	27.989	2.017	10.086	21.827
3	1.685	8.427	36.417	1.685	8.427	36.417	1.988	9.942	31.769
4	1.578	7.888	44.304	1.578	7.888	44.304	1.950	9.749	41.518
5	1.453	7.267	51.572	1.453	7.267	51.572	1.611	8.055	49.573
6	1.205	6.027	57.599	1.205	6.027	57.599	1.605	8.026	57.599
7	.992	4.960	62.558						
8	.951	4.753	67.312						
9	.865	4.323	71.635						
10	.827	4.135	75.770						
11	.735	3.677	79.447						
12	.686	3.431	82.878						
13	.643	3.217	86.095						
14	.551	2.756	88.852						
15	.491	2.457	91.308						
16	.466	2.330	93.639						
17	.355	1.774	95.413						
18	.345	1.723	97.137						
19	.297	1.483	98.620						
20	.276	1.380	100.000						

Extraction Method : Principal Component Analysis.

Table - 1

Cronbach's Alpha	N of Items
.762	20

check whether random error causing inconsistency and in turn lower reliability is at a manageable level or not, by running reliability test. From table 1 it is clear that the values of coefficient Alpha (Cronbach's Alpha) have been obtained, the minimum value of coefficient Alpha obtained was .762. This shows data has satisfactory internal consistency reliability.

Factor Analysis :

Hypothesis 1 : there is a relationship among the factors that enhances the satisfaction of customers in star hotels.

Table 2 : KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.607
Bartlett's Test of Sphericity	Approx. Chi-Square	793.622
	Df	190
	Sig.	.000

KMO measure of sampling adequacy is an index to examine the appropriateness of factor analysis. High values 0.5 and 1.0 indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate. From the above table it is seen that Kaiser-Meyer-olkin measure of sampling adequacy index is 0.607 and hence the factor analysis is appropriate for the given data set. Bartlett's test of Sphericity is used to uncorrelated. It is based on chi-square transformation of the determinant of correlation matrix. A large value hypothesis. In turn this would indicate that factor analysis is appropriate. Bartlett's test of Sphericity Chi-square statistics is 793.622, that shows the 20 statements are correlated and hence as inferred in KMO, factor analysis is appropriate for the given data set. (See Table 3)

Eigen value represents the total variance explained by each factor. Percentage of the total variance attributed to each factor. One of the popular method used exploratory factor analysis in principle component analysis, where the total variance in the data is considered to determine the minimum number of factors that will account for maximum variance of data depicted. (See Table 4)

Interpretation of factors is facilitated by identifying the statements that have large loading in the same factor. The factor can be interpreted in terms of the statement that loads high on it.

The factors that enhances the customer satisfaction in star hotels comprises of 20 individual statements. Out of 20 factors, 6 individual factors contribute more towards the satisfaction of the consumers. The factors are:

(1) Room Facility (2) Reception (3) Restaurant (4) Tariff (5) Good Location (6) Hospitality and service by hotel staff

Multiple Regression :

Hypothesis 2 : Hospitality and Comfortable Rooms can predict the overall satisfaction of customers towards star hotels.

Table 5 : Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.899 (a)	.808	.789	.181

a Predictors : (Constant), Reception, Restaurant, Trips, Rooms, Entertainment and Location

The above model summary table shows R-square for this model is 0.808. This means that 80.8% of the variation in overall satisfaction of customers (dependent variable) can be explained from the 6 independent variables. The table also shows the adjusted R-square for the model as 0.789.

Table 4 : Rotated Component Matrix (a)

	Component					
	1	2	3	4	5	6
Restaurant	.005	-.127	-.039	.120	.757	.001
Entertainment	.498	-.206	-.076	.137	-.013	.200
Kids club	.656	.045	.082	.438	-.115	-.127
Reception Service	.747	.110	.189	-.128	-.055	-.152
Atmosphere	.731	.138	-.054	.126	.037	.093
Interiors	.149	.666	.102	.190	.229	-.167
Rooms are comfortable	.098	-.081	.153	.788	.055	-.008
Room service	.176	-.154	.634	.369	.154	-.109
Appealing Image	.026	.096	.311	.427	.258	-.064
Opportunities for relaxation	.190	-.129	.516	.345	-.468	.030
Tariff is not very high	.131	.342	.647	-.001	-.045	-.027
Spacious	.168	.337	-.103	.668	-.189	.107
Bar facilities	-.236	.021	-.112	.324	.100	.562
Good Location	.011	.742	.015	-.035	-.102	.154
Swimming Pool	-.117	.600	.447	.096	-.012	-.020
Beauty Parlor	-.104	.254	.307	-.087	.550	.119
Fitness centre	-.190	.183	.617	-.059	.153	.317
Excellent service by hotel staff	.175	-.180	.112	-.058	.065	.773
Good hotel transfer	.103	.390	.056	-.149	-.061	.631
Reputation	.525	-.043	.064	-.009	.513	.101

Extraction Method : Principal Component Analysis.

Rotation Method : Varimax with Kaiser Normalization.

A Rotation converged in 12 iterations.

Anytime another independent variable is added to a multiple regression model, the R-square will increase (even if only slightly). Consequently, it becomes difficult to determine which models do the best job of explaining variation in the same dependent variable. The adjusted R-square does just what its name implies. This adjustment allows the easy comparison of the explanatory power of models with different numbers of predictor's variable.

Table 6 : Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.342	.482		11.086	.000
	Comfortable Rooms	.310	.050	.569	6.170	.000
	Reception	-.180	.027	-.545	-6.550	.000
	Entertainment	.026	.048	.043	.543	.588
	Trips	.074	.041	.170	1.833	.068
	Restaurant	-.196	.042	-.420	-4.707	.000
	Location & Hospitality	.348	.042	.735	8.196	.000

A Dependent Variable : satisfaction with star hotels.

To determine if one or more of the independent variables are significant predictors of overall satisfaction

of customers, we examine the information provided in the coefficient table. From the above 6 independent statements only 2 statements are not statistically significant. The standardized coefficient beta column reveals the rooms have a beta coefficient .569, which is significant (.000). Reception has a beta coefficient -.545, which is significant (.000). Entertainment has a beta coefficient .043, which is not significant (0.588). Trips have a beta coefficient 0.170, which is not significant (0.068). Restaurant has a beta significant -.420, which is significant (.000). Location & Hospitality have a beta coefficient .735, which is significant (0.000). It is clear that Location of the hotel and hospitality along with Good rooms are having major impact in the minds of the consumer and brings them lot of satisfaction when compared with other factors in preferring Star hotels at Hyderabad.

Conclusion :

Customer Satisfaction and Image directly influence Behavioral Intentions. Satisfied customers form favorable behavioral intentions to revisit or return to the same hotel when they experience high levels of service quality that produce a favorable image. The results of this study indicate that 6 individual factors contribute more towards the satisfaction of the customers they are Comfortable rooms, Good restaurant, Hospitality, Nominal Tariff, and Ideal Location. The findings provide hotel management with an improved understanding of the influence of service quality on perceived

value and image, the influences of perceived value, image and service quality on customer satisfaction, and the effects of image and customer satisfaction on behavioral intentions. Management needs to be aware that increasing service quality should increase their customers' perceptions of value and create favorable impressions of the hotel.

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