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Indoor Information Transmission System through Light as a Media

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Abstract— Fluorescent light is used as the medium to transmit information, which is encoded by using a pulse frequency modulation technique. The user receives the encoded light information through a LDR receiver. The information is passed into the wearable or mobile computer after the data are decoded. This information allows positioning information to be given to indoor mobile and wearable computers. It is one of the cheapest methods for indoor tracking used for applications such as navigation and guidance. More functional area compared to IR Lowest tracking performance.

Keywords- Manchester code, FL, LED,GPS,IR,MOSFET .

I. INTRODUCTION

Tracking people and objects became a very interesting field of research in the last ten years. The theory of positioning has been used in various application areas. For example, a company could acquire the necessity to position its equipment to track down its assets. Additionally, indoor positioning is very useful for positioning people within buildings such as hospitals and nursing homes (e.g., positioning the first responders of a rescue team in a building, given the absent of a Positioning system). These applications require positioning, either to track down people or to guide them to a certain place within a building in order to save their lives.

In an outdoor environment, the Global Positioning System (GPS) works efficiently in positioning and targeting different types of entities. It has been used in many outdoor applications for localizing people, cars, as well as other objects. However, GPS lacks the same level of efficiency when used within indoor environments. This problem is due to the existence of obstacles that can weaken the signal of the GPS (e.g., building architecture, walls) where the existence of different equipment can cause a noise in the GPS transmitted signal. Proposed a indoor information transmission system for indoor positioning and navigation that should be implemented within the indoor environment in order to position and track objects. In this project, review the different positioning environments, the different systems applied for each environment and the algorithms used within each system.

White light-emitting diodes (LEDs) designed for illumination can also be modulated up to a few megahertz to transmit their coordinate information to a portable receiver (Grubor et al., 2008). This makes the new emerging technology of visible light communication a very suitable candidate for developing indoor positioning systems. In future the white LEDs will replace incandescent and fluorescent lighting due to their higher energy efficiency, longer life expectancy, higher tolerance to humidity and environmental friendliness (Swook et al., 2010). More importantly, indoor positioning system introduces an enormous range of applications including asset tracking, providing navigational aids to visually impaired, guidance system for mobile robots and industrial automation.

Moreover, visible light transmissions are confined to the room in which they originate since light cannot pass through walls or other opaque barriers, therefore it is easy to secure transmissions against eavesdropping and prevents signal interference between rooms' (Kahn and Barry, 1997: 1).

The main source of noise for visible light communication systems is the intense ambient noise in many indoor environments, arising from the sunlight and other light emitting sources like incandescent lightings which could potentially degrade the performance of the indoor positioning system.
In this work, a hemispherical lens is attached to the receiver, enlarging the receiver's field of view and allowing it to receive more signals under most circumstances (Wang et al., 2013). The receiver can estimate its position more accurately with more coordinate information from additional received signals. It will provide information with secured manner on LCD display.

II.PROPOSED METHODOLOGY

Various methods were examined by the researcher for the purpose of indoor positioning system. But still there is scope for improving innovative and economical form of indoor positioning and navigation method. By using an economical light sensor to build this indoor tracking system, it can be able to infer the user's location in an indoor environment which will be verify and implement in this dissertation. In this chapter, several currently developed and overlooked ideas and options exist, and these can provide new Indoor positioning systems. Indoor positioning is a huge area, with many applications Various indoor positioning techniques. Many improvements can be carried for different systems. Fixed indoor positioning systems have a better accuracy compared to the pedestrian positioning systems. It can be discussed the challenges that can be faced when designing an indoor positioning system, elaborated on different solutions proposed to overcome these challenges and provided a possible area of application and enhancement within indoor positioning systems. It can be noticed Indoor Positioning is a huge area with many applications and many improvements to be carried. As mentioned earlier in this chapter, researches within indoor positioning could be more useful if carried for pedestrians positioning since the accuracy reached is not as accurate as the accuracy reached in fixed indoor positioning. From this chapter, it can brief view of all researchers premeditated the different methods to developed the individual System. Heading in the direction of their aim they effectively designed indoor positioning system using simple component and gave new thoughts to world along with future scope for other researcher in the same field.
As this indoor tracking and positioning system is small and light, it can be worn by the user together with the outdoor wearable GPS tracking system at the same time. The system can detect which signal (GPS or indoor light) is being received, and tracking can be continued from the outdoor to indoor by simply switching from an outdoor GPS system to the indoor light-sensor system. When the user enters the indoor environment, indoor information is provided by continuing the position information from the outdoor to the indoor environment. Thus, the indoor and outdoor positioning systems are seamlessly combined. In this, compares the proposed system with other technologies used in indoor tracking in terms of accuracy and cost.

Table 1. Comparison of different indoor tracking systems

	Cost in USD	Accuracy	Technology
Intersence IS-900	Over 15000	1mm	ultrasound
Rendell's system in(17)	150	10-15 cm	ultrasound
Ekahan	100-200	1m	Wi-Fi
Proposed System	Less than 10	3-4m	Light

III. HARDWARE SYSTEM

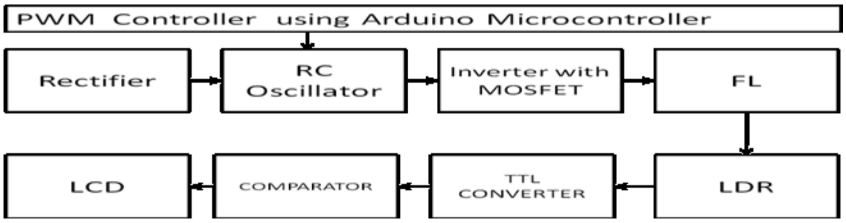

Figure 1. Block diagram of a Indoor Information Transmission System using light as a media

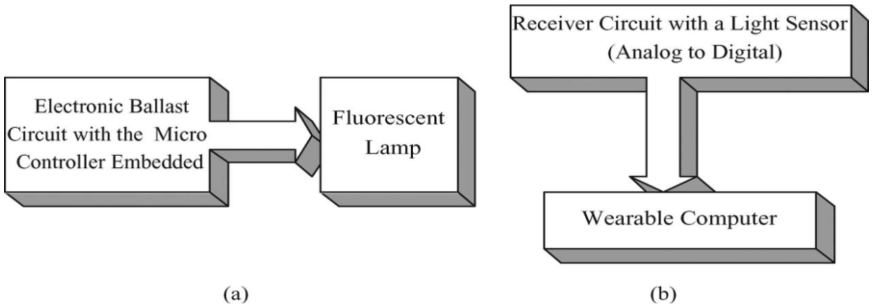

Figure 2. Simple schematic scheme of the system. (a) Transceiver. (b) Receiver

The Main Concept behind this technique is to generate hardware for the developed transmitter and the electronic ballast circuit used for the transmission purpose consists of three parts: the ac–dc rectifier, the dc–ac converter (inverter), and the resonant filter circuit. The lighting of the fluorescent lamp is due to the arc current running through the lamp. When the amplitude and frequency of the arc current is appropriate, the lamp will light up. Amplitude and frequency are the two key factors for the lamp output. Therefore, changing the frequency of the arc current may encode all the information into the fluorescent light. If the modulation frequencies are high enough, the information will be transmitted without flickering due to the characteristic of human vision [10]. Since it has be required to design a very cheap and economic circuit for indoor tracking, it use a commercial electronic ballast system for a fluorescent lamp and performed small modifications on the circuit. The only components that it can be added to the original circuit were a micro controller, a low-power MOSFET and a simple capacitor .The MOSFET is used for switching purposes and is controlled by the micro controller. Whenever the MOSFET is on, the 80-pF capacitor is parallel with the original 270-Pf capacitor, which will change the lighting frequency from 40 to 35 kHz. Therefore, it can simply transmit digital data through the light .Since it can be used simple and very cheap modifications on an available electronic circuit by changing the frequency, it can be observed that the amplitude of the light is slightly changed as well. Consequently, after transmitting a byte such as "00001111," a flickering effect will be sensed by normal human eyes. To solve this flickering problem, the first solution was to change their design and add more components to the circuit, but it would increase the total cost of the hardware. The second solution was to solve the problem in software. Since they are using a micro controller in that circuit, it can encode the data in such a way that data level frequently changes in a short time and therefore human eyes cannot sense the changes in the light. One of the encoding protocols for this solution is the Manchester coding method [11]. In this method, the signal edge in specific time periods is used to indicate the 0 or 1 logic. Manchester codes are encoded into arc voltage by frequency variations. As can be seen in this figure, although the voltage level for frequencies of 35 and 40 kHz are slightly different, since there is frequent changes in signal due to Manchester coding, there will be no flickering effect in the transmitted light.

3.1 Transmitter model and Receiver model

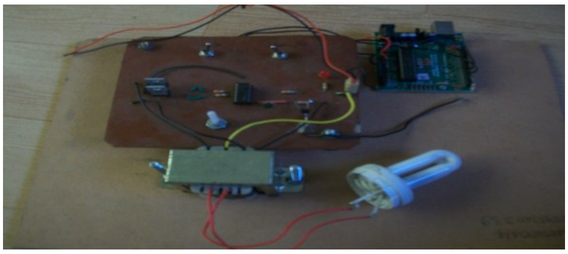

Figure 3. Transmitter model

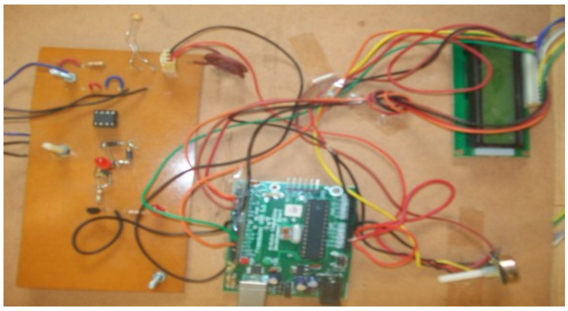

Figure 4. Receiver model

At receiver LDR is used to sense the light. Comparator will compare change in intensity. At receiver, deciding of sequence since receiving code is with high security sequence predefined coded. In industry light is fitted by using 230v.For our system it will require 180 V. It has been done step-up transformer. To receive message put receiver respective rooms to sense the light. For our system, one transmitter many receiver.

IV.DATA FLOWCHART FOR THE SYSTEM

The messages and information appear on the LCD which does not affect the user's eyesight range, providing the user with real-time environmental information. Fig. 5presents the Data flow of the proposed indoor information transmission through light as a media system.

4.1 Flowchart

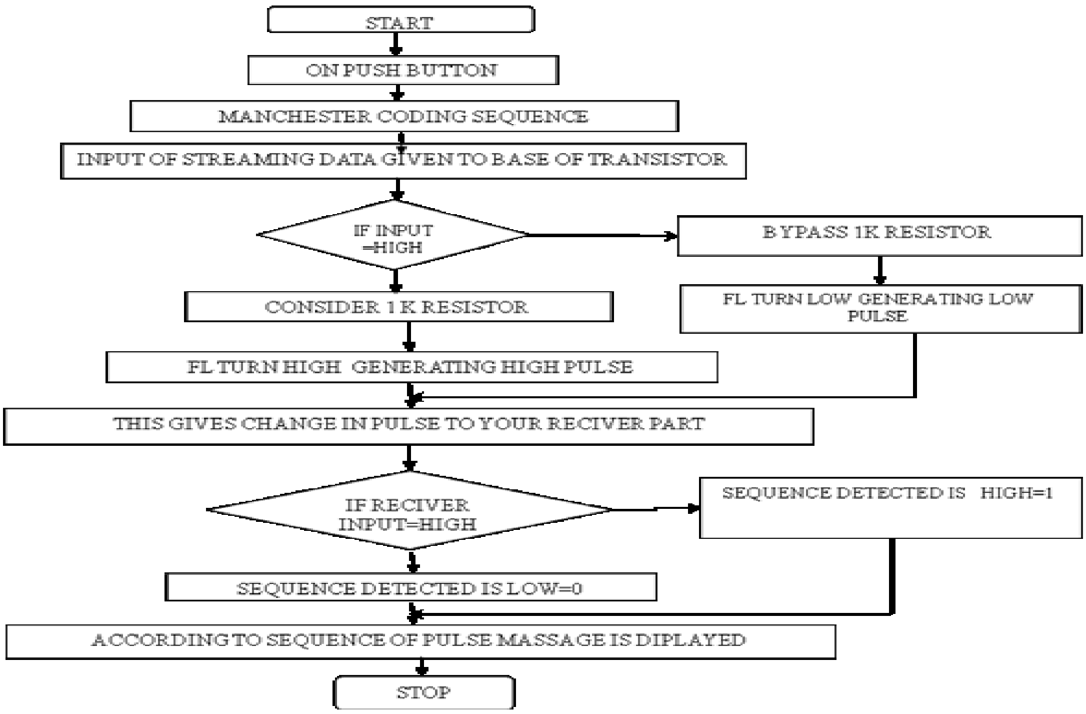

Fig.5. Data flow of the proposed indoor information transmission through light as a media

V. RESULT

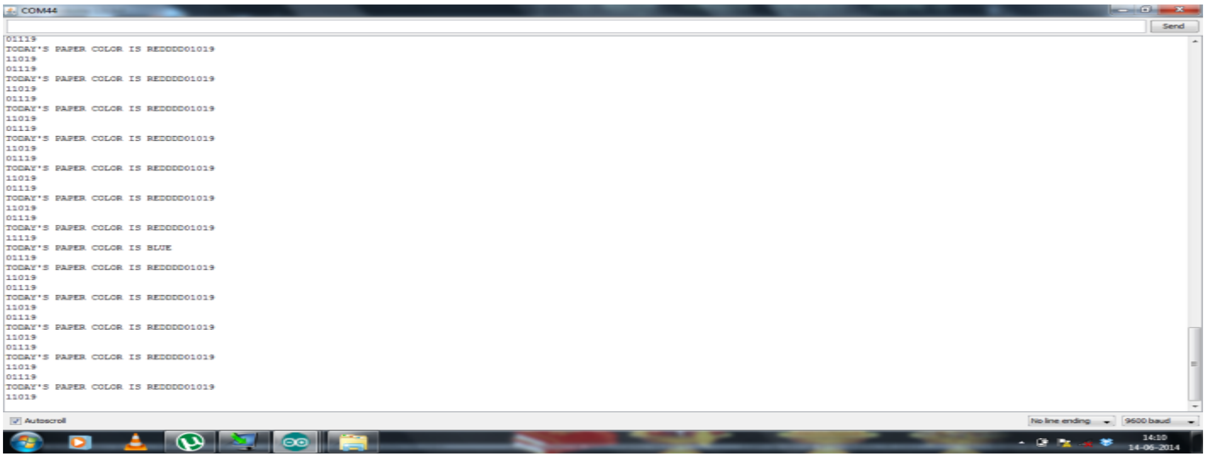

Fig.6 Result of indoor information transmission using light as a media

When blinking, we have to set condition for properly reading. Angle should be proper to observe the reading. When transistor input is high, LED ON and it will print'1'.For pattern analysis,1 second delay is given. If we will remove the delay then it will doesn't mean of synchronization. Changing the frequency of arc current may encode all the information into FL. The MOSFET is used for switching purpose and is controlled by micro controller. Whenever MOSFET is ON, C=80 pf paralyzed with original 270 pf which will change the lighting frequency from 40 to 35 KHz.

Manchester codes are encoded into arc voltage by frequency variation. Voltage level for frequency from 35 kHz and 40 kHz are slightly different since there are frequent changes in signal due to Manchester coding. There will be no flickering effect in transmitted the transmitted signal.
Flickering problem can be solving by adding more components to circuit but it will increase cost of hardware. Software installation micro controller using in circuit. All the information which is sending out by FL at each location is set in main programme.
While taking reading, number of sample reading observed while toggles the switches. Out of that which is mostly getting that sequence of code must be assigned according to our need. Here in this programme we have assigned '0111'as a RED colour and '1111'as a BLUE colour. Two switches which are used to generate message 1 and message 2.We are changing intensity of light by changing frequency with change in R and C .Frequency difference is small since it will small change in light intensity so anyone can't observe that flickering.Swich1 and Switch 2 will generate sequence code (Manchester code). With micro controller PWM will generated.
Push button is used to select Manchester code sequence that code sequence (streaming data)is applied to base of transistor. When input is high (1) then it will bypass 1KΩ resistor. It will turn off FL and generating low pulse and vice versa. Finally, according to ON/OFF of FL will gives change in pulse. This change in intensity of light will sensed by LDR. If receiver input is low then detected sequence is'0' and vice versa. According to sequence of pulse, message is displayed. Thus, it can be send text message with security by using light intensity with Manchester coding.
Comparator will convert into TTL converter. Intensity is given to TTL and TTL is given to Arduino. Arduino recognizes transmitted data. Finally, character display on LCD display.

VI.CONCLUSION

By using an economical light sensor to build indoor information transmission system. For example, it can put the system on both sides of the doors of each room in a building; then, a user will receive the proper data by entering or leaving the room. When data, which are encoded in the fluorescent light, is received by the receiver and analyzed by the LCD, it will provide required messages. Specifically, this light-sensor based indoor information transmission system is robust and much cheaper than those using electromagnetic ultrasonic sensors. Furthermore, the receiver circuit is light and small, and it can be well suited to wearable computer applications. Aside from the technical achievements of our work to date, it is significant to point out that the application of this system provides an innovative and economical form of indoor information transmission system. It must be noted though that the proposed system has limited bandwidth and is therefore more suitable for transmitting text messages to the user's wearable computer or LCD rather than images or graphics.

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