DATA CHANNELING AND HOME AUTOMATION VIA OPTICAL FIBER CABLE

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ABSTRACT

Now we are in the twenty first century, the era of 'Information technology' there is no doubt that information technology has an exponential growth through the modern telecommunication systems. Particularly, optical fiber communication plays a vital role in the development of high quality and high-speed telecommunication systems. The Project consists of Arduino Uno boards using Atmel ATMEGA 328 and optical fiber. Data Transmission takes place using Arduino compiler Arduino.cc to send and receive data (string form data) and to send automation commands simultaneously to 3 output power ports attached using driver relay circuits on the transmitter end Arduino board.

Keywords: Optical Fiber cable, Data Transmission, Automating home appliances, Arduino.

I. INTRODUCTION

Optical fiber refers to the medium and the technology associated with the transmission of information as light pulses along a glass or plastic wire or fiber. Optical fiber carries much more information than conventional copper wire and is in general not subject to electromagnetic interference and the need to retransmit signals. Most telephone company long-distance lines are now of optical fiber. Transmission on optical fiber wire requires repeaters at distance intervals. The glass fiber requires more protection within an outer cable than copper. For these reasons and because the installation of any new wiring is labor-intensive, few communities yet have optical fiber wires or cables from the phone company's branch office to local customers (known as local loops). Optical fiber consists of a core, cladding, and a protective outer coating, which guide light along the core by total internal reflection. The core, and the higher-refractive-index cladding, are typically made of high-quality silica glass, though they can both be made of plastic as well. An optical fiber can break if bent too sharply. Due to the microscopic precision required to align the fiber cores, connecting two optical fibers, whether done by fusion splicing or mechanical splicing, requires special skills and interconnection technology. Two main categories of optical fiber used in fiber optic communications are multi-mode optical fiber and single-mode optical fiber. Multimode fiber has a larger core allowing less precise, cheaper transmitters and receivers to connect to it as well as cheaper.

Today, optical fibers are not only used in telecommunication links but also used in the Internet and local area networks (LAN) to achieve high signalling rates. Optical fiber can attend a speed of up to 1 Gbps in a more energy convenient manner. Use of Light energy transmission makes it next to impossible to crack down the encoded data which makes Optical Fiber Transmission more secure as compared to other modes of transmissions.

An optical fibre consists of a very thin glasses core (5 mm to 50 mm in diameter) surrounded by a glass coating called cladding. The glass core and cladding are enclosed in a protective jacket made of plastic. The refractive index of the glass used for making core (m) is a little more than the respective index of the glass used for making the cladding (m2) i.e.m1> m2.

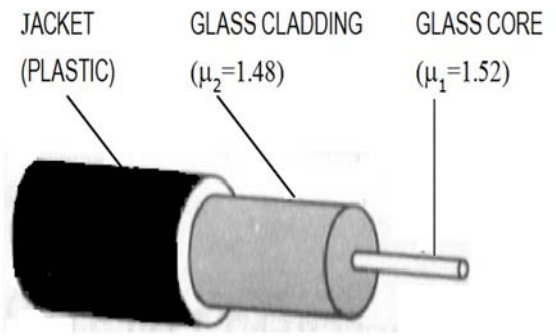


Fig 1.optical fibre cable used in the system

In optical fibre, the value of refractive index of core is 1.52 and the value of refractive index of cladding is 1.48 respectively.

Automation breaks down to Automatic control which further simplifies to one of its subsidiaries as remotely controlled applications .Automation is the next age technology that would spread its webs all over the world completely not much far away. Automation provides means for more simplified, Precise, energy economical as well as cost economical solutions for all sectors of life be it household or any Industrial sector.

This paper presents a low cost and flexible home control and environmental monitoring system. It employs an embedded micro – web server in Arduino Mega 328 microcontroller, with optical fibre connectivity for accessing and controlling devices and appliances To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, temperature sensor, gas sensor and motion sensors have been integrated with the proposed home control system.

Using these two high end technologies we attempted to achieve string text data transmission and Automation simultaneously from two Personal computers connected via Arduino Uno board.

II. SYSTEM HARDWARE AND SOFTWARE REQUIREMENT

A. BLOCK DIAGRAM OF PROPOSED SYSTEM

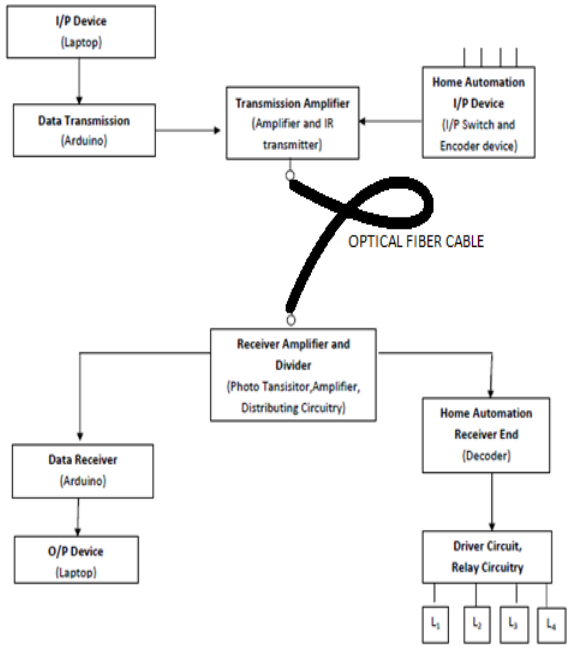


Fig. 2. Block Diagram of proposed system

Fig.2. is a simplified form block diagram representation for Project. I/P and O/P device will be 2 personal computers connected using Arduino UNO with fiber cable attached for transmission. Port 10 and 11 are interfaced for transmission and receiving purpose apart from default ports provided. At receiver end transmission amplifier is connected via optical fiber to receiver amplifier which then follows two different pathways for data transmission or Automation purpose. Home Automation connects to relay circuits transmitting power to output ports as per commands.

B. COMPONENTS USED

1) Software Requirements

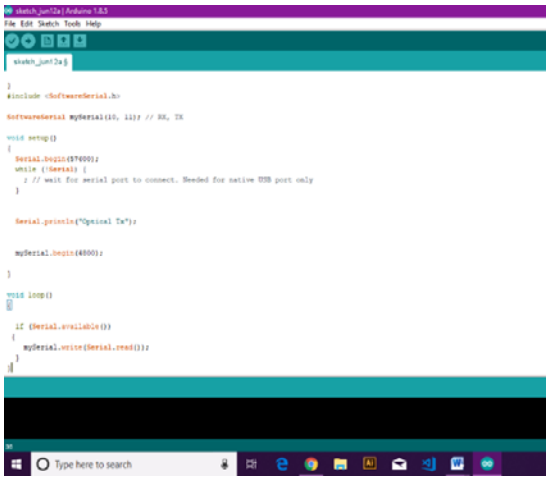
- Proteus circuit design :

The **Proteus Design Suite** is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

- Arduino compiler :

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures

single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world.



2) Hardware Requirements:

- Arduino Uno x2
- Personal Computers x2
- Optical fiber cable
- Resistors (220 ohm x2, 10k x1)
- LED
- Photodetector
- Relay circuit boards
- Output ports

III. Software Simulation :

- Transmitter :

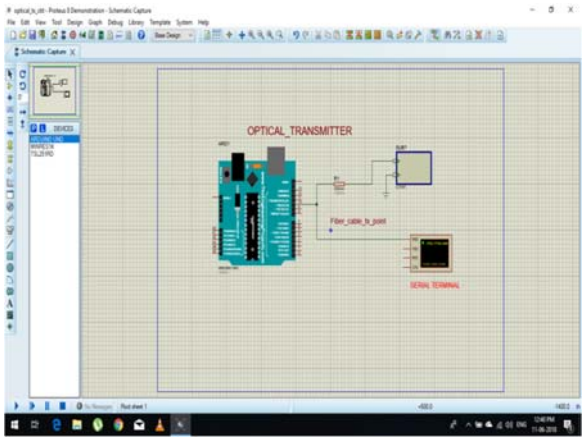


Fig. 3 Simulation of data transmission

- Receiver End :

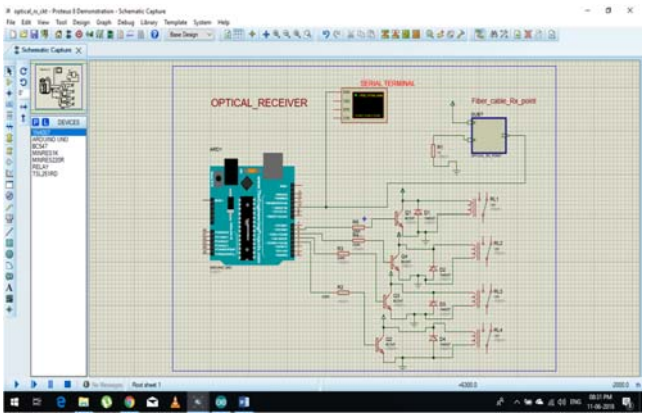
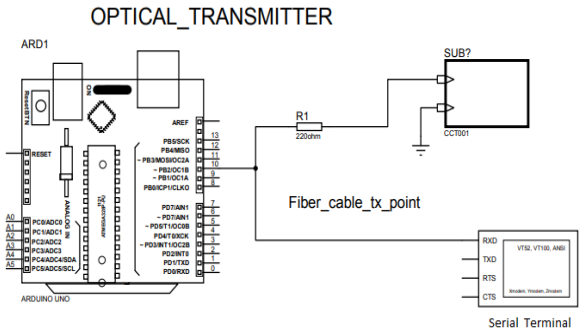


Fig. 4 Simulation of data reception

IV. IMPLEMENTATION

This Section will give a detailed description of the functioning of the proposed system

A. TRANSMISSION



- **Transmitter :**

The heart of the transmitter is a light source. The major function of a light source is to convert an information signal from its electrical form into light. Today's fiber-optic communications systems use, as a light source, either light-emitting diodes (LEDs) or laser diodes (LDS). Both are miniature semiconductor devices that effectively convert electrical signals into light. They need power-supply connections and modulation circuitry. All these components are usually fabricated in one integrated package.

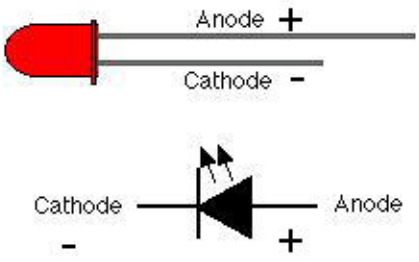
- **Optical fiber:**

The transmission medium in fiber-optic communications systems is an optical fiber. The optical fiber is the transparent flexible filament that guides light from a transmitter to a receiver. An optical information signal entered at the transmitter end of a fiber - optic communications system is delivered to the receiver end by the optical fiber.

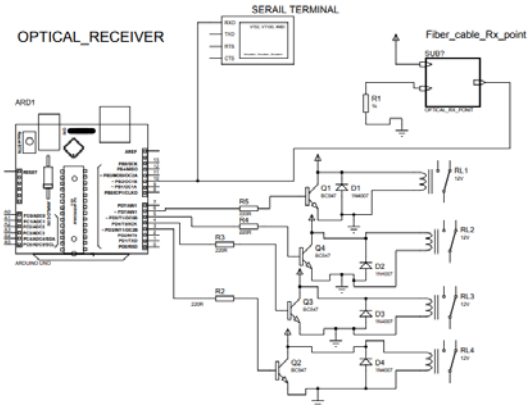
Model Diagram for Plastic Fiber cable

- **Transmitting LED :**

We have used RED colored IR led as the transmitter. This will convert the serial data into optical data which suitable for the optical wire. As a driver we added 220ohm resister to Anode terminal of the IR led.

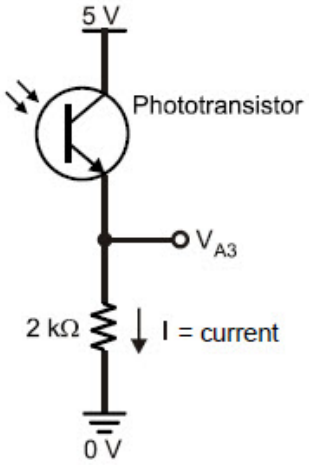


B. RECEPTION



- Photo Detector:

The key component of an optical receiver is its photo detector. The major function of a photo detector is to convert an optical information signal back into an electrical signal (Photocurrent). The photo detector in today's fiber - optic communications systems is a semiconductor photodiode or phototransistor. We used phototransistor. This miniature device is usually fabricated together with its electrical circuitry to from an integrated package that provides power-supply connections and signal amplification.



Data recovered from the optical cable, collecting and displaying on the serial monitor.

For the automation we are using the same method. By using serial communication we are controlling the different devices with the help of relay board.

V. MERITS AND DEMERITS

The fiber optic system has enabled the communication industry to rapidly develop new advancements in technology. The system offers many advantages over the traditional metal (copper) wire form of communications.

These advantages include:

- Less expensive for higher transmission system.
- Higher carrying capacity.
- Lower power requirements.
- Non-flammable.
- Flexible and light weight

Merits of ARDUINO:-

- Inexpensive.
- Cross-Platform
- Simple, clear programming environment.
- Open source and extensible software, hardware.

There are some limitations of optical fiber. They are as follows:-

- More expensive for lower transmission system.
- Hard to install and maintain.

VI. CONCLUSION

The growth of the fiber optics industry over the past five years has been explosive. Analysts expect that this industry will continue to grow at a tremendous rate well into the next decade and beyond.

In this project we aim transmission of data and automating home appliances via optical fiber cable. The purpose of the project is successfully fulfilled. The functioning of the appliances is integrated with the optical fiber cable using UART protocol. The project proves to be accurate, reliable and more efficient than the existing controllers.

With this in mind, we hope this paper will provide the people with a rudimentary understanding of fiber optic communication systems and its technology.

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