

# IoT Based Smart TV for Child Eyes Safety

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**Abstract-** The most neglected issue that is of the child eyes safety while watching the television from a closer distance eventually causing degradation of the retina. Due to which most of the children get opted to specs in small age. So, our system which is a model based on the concepts of Internet of Things and Sensors can reduce the rate of retina degradation at some extent. If some critical distance is maintained from the television screen then it will reduce the rate of strain on eyes while watching television. The Arduino is used as the core part of the system, which controls the sensors and act as per the input from the sensors. This system if developed further can also be used for the child tracking using the camera and sensors.

**Keywords-** Internet of Things, Sensors, Retina, Arduino, Television.

## I. INTRODUCTION

With the ever-increasing advancement in technology, it has brought the advantages to the user of the technology. But, with this, it has also brought many disadvantages causing harmful effects on the user of the technology.

The system proposed in this paper focuses on one similar harmful effects caused due to the radiations emitted from the TV screen. The backbone of the system is the Internet of Things. Due to advancement in the Internet of Things, it has become really easy to control the devices from remote locations and automate the systems. Our systems target audience is the small children, as they watch the television from a quite closer distance, which eventually causes slow degradation of the seeing ability of the children.

The system is totally controlled by the Arduino micro-controller board which is the central entity responsible for controlling the sensors and other modules in the overall system. The system consists of 3 modules viz., Arduino, GSM SIM900 Module, Camera and Ultrasonic sensor.

The safe distance for watching the television is around 2 to 3 meters from the television screen, so we are going to detect the distance using the ultrasonic sensor and also the camera is used for detecting the object i.e., children whether it is looking towards the television or any other area. If the system finds the critical distance crossed it will wait timer of 15 seconds to finish and the Arduino will be

triggered for sending SMS to the parents of the children so they can decide whether to off the TV or not. They will send the key to the GSM module which in turn will be checked by the Arduino and then the action will be taken depending on the response from the parents.

## II. MOTIVATION

This paper gives an overview of a new system based on the Internet of Things. The small children getting specs in small age, though it is not a serious problem it should be acknowledged so that this rate can be reduced. This can also cause a problem like a retina degradation, strain in eyes, watery eyes. This problem, if not looked upon, can also cause serious problems. As such systems are not available in the market, it will be a helpful system for parents for looking on to their children when they are not home.

## III. SYSTEM ARCHITECTURE

There are various modules and sensors used in this system which are discussed in brief in the following section.

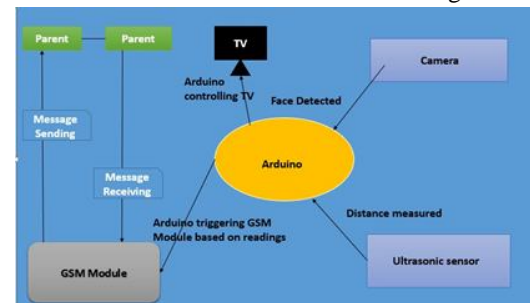


Fig. 1. System Architecture

In the above architecture the main components visible are:

- 1) Arduino Uno
- 2) GSM Module
- 3) Camera
- 4) Ultrasonic Sensor

## IV. COMPONENTS OF SYSTEM

A. Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical

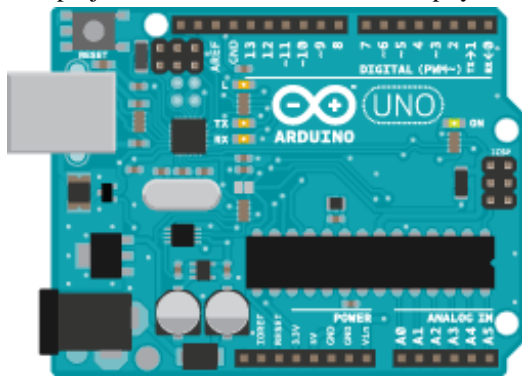


Fig. 2. Arduino Uno

programmable circuit board (often referred to as a micro- controller) and a piece of software, or IDE (Integrated De- velopment Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package. [8]

B. What’s on Arduino ?

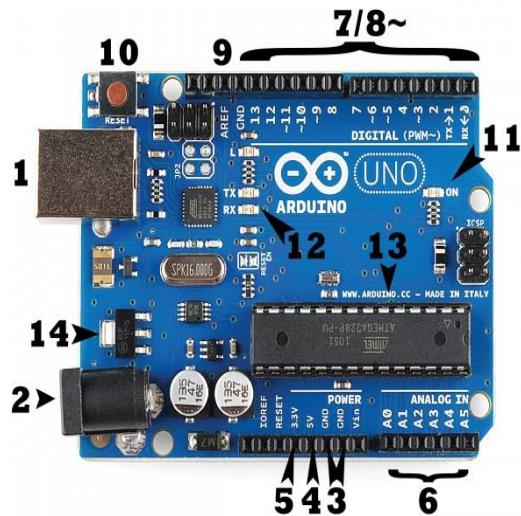


Fig. 3. Arduino Components

- 1) Power (USB / Barrel Jack)
- 2) Pins (5V(4), 3.3V(5), GND(3), Analog(6), Digital(7), PWM(8), AREF(9))
- 3) Reset Button(10)
- 4) Power LED Indicato(11)
- 5) TX RX LEDs(12)
- 6) Main IC(13)
- 7) Voltage Regulator(14) [8]

C. GSM Module



Fig. 4. GSM SIM900 Module

A GSM Module is basically a GSM Modem (like SIM 900) connected to a PCB with different types of output taken from the board say TTL Output (for Arduino, 8051 and

other microcontrollers) and RS232 Output to interface directly with a PC (personal computer). The board will also have pins or provisions to attach mic and speaker, to take out +5V or other values of power and ground connections. These type of provisions vary with different modules. Lots of GSM Module are available in market but the compatible on with the Arduino is to be used here.

The GSM Module shown in the figure is the SIM900 GSM Module which means that the module supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in the 900Mhz band. If you are from another country, you have to check the mobile network band in your area. A majority of United States mobile networks operate in 850Mhz band (the band is either 850Mhz or 1900Mhz). Canada operates primarily on 1900 Mhz band. [9]

1) Interfacing Arduino with GSM Module:

There are two ways of connecting GSM module to arduino. In any case, the communication between Arduino and GSM module is serial. So we are supposed to use serial pins of Arduino (Rx and Tx). So if you are going with this method, you may connect the Tx pin of GSM module to Rx pin of

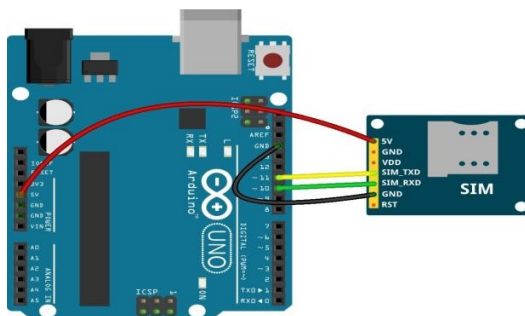


Fig. 5. Interfacing Arduino with GSM Module

Arduino and Rx pin of GSM module to Tx pin of Arduino. You read it right ? GSM Tx ; Arduino Rx and GSM Rx ; Arduino Tx. Now connect the ground pin of arduino to ground pin of gsm module! So thats all! You made 3 connections and the wiring is over! Now you can load different programs to communicate with gsm module and make it work.

This connection can cause problem while loading the pro- gram on Arduino as Arduino uses serial ports to load program from the Arduino IDE. If these pins are used in wiring, the program will not be loaded successfully to Arduino. So you have to disconnect wiring in Rx and Tx each time you burn the program to arduino. Once the program is

loaded successfully, you can reconnect these pins and have the system working!

To avoid this difficulty, we can use an alternate method in which two digital pins of arduino are used for serial communication. We need to select two PWM enabled pins of arduino for this method. This method is made possible with the Software Serial Library of Arduinio. Software Serial is a library of Arduino which enables serial data communication through other digital pins of Arduino. The library replicates hardware functions and handles the task of serial communication. [9]

D. Ultrasonic Sensor



Fig. 6. Ultrasonic Sensor

Ultrasonic Sensor HC-SR04 is a simple sensor which emits Ultrasonic Radiations from its transmitter and is used for

This sensor consists of four pins, which are:

- 1) Vcc (+5V) : You need to provide +5V at this Ultrasonic Sensor HC-SR04 Pin.
- 2) Trig (Trigger) : Its a trigger Pin where we need to provide a trigger after which this sensor emits ultrasonic waves.
- 3) Echo : When Ultrasonic waves emitted y the transmitter, hit some object then they are bounced back and are received by the receiver and at that moment this echo Pin goes HIGH
- 4) GND : We need to provide ground to this PIN of HC-SR04 Ultrasonic Sensor.

Trigger pin is an output pin while the Echo pin is an input pin. Moreover, it requires +5V to start operating. It is normally used to detect objects in front of it or to measure the distance between different objects.

1) Interfacing Ultrasonic Sensor with Arduino:

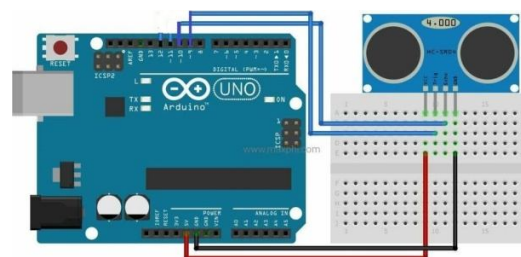


Fig. 7. Ultrasonic Sensor Interfacing

Above figure shows the interfacing of the Ultrasonic Sensor with the arduino used for distance calculation of the object from the TV screen.

E. Camera

Camera is used in addition to the ultrasonic sensor for distance calculation and children detection. The OpenCV software is used for detecting whether the children is looking towards the television screen or not.

1) OpenCV: OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products.

This library contains optimized algorithms which can be used for detecting and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. [3]

F. Overall Flow of System

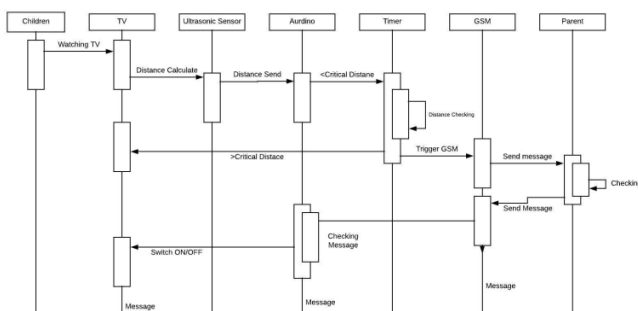


Fig. 8. Sequence Diagram

The Sequence Diagram in the above figure shows the overflow of the system. It also gives the overview of the working of the system.

V. CONCLUSION

Hence, the different IoT devices, applications and Sensors are studied and the model of the system is built. Hence, the system if deployed in live environment can be used for reducing long exposure of child eyes with TV.be an

efficient tools in urban planning and Groundwater Managements Hydro geomorphological studies with the Hydro Geological and structural or lineament have proved to be very effective tools to estimate Ground water potential zones in the Watershed.

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