

Class Room Automation System with Microcontroller

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Abstract-

Microcontrollers are smaller version of modern computers that can be used in many functionalities. With help of some basic sensors we can use the technology of the microcontrollers to build a automated class room. This paper's aim is to develop and design a Class room automation using Arduino, D6T sensor, DIR sensor, BH1750 light intensity sensor and NTC Thermistor Temperature sensor module. The paper mainly focuses on the monitor and control of smart class by microcontroller. This paper motive is controlled electronic appliances in smart class with user friendly, design at low cost, simple installation.

Keywords- Arduino, D6T , DIR, LDR, NTC

Introduction

In the 3rd decade of 21st century the world is moving fast towards automation. In developing countries like India every year billions of units of power is wasted each year. With automation systems this amount can be decreased. Complete class room automation with extra manual control is the main aspects of this project. So that the system will control the wastage of electricity and also make everything easy for humans. The proposed system will count the number of human inside at a time and locate their position inside the room and then if needed, it will turn on or turn off the nearest lights and fans from the human. Anyone inside the room can also control all the electronics manually by using their android phone by connecting it with the system via Bluetooth.

Sensors-

DIR motion detector sensor, D6T-44L thermal sensor, NTC temperature sensor, BH1750 light intensity sensor.

Working of components

Working of System Automatic:

Microcontroller- Arduino Uno

Related works in this area

The most related work on this area has done by a team of SSN College of Engineering, Anna University, and Chennai. Mr. Satish Palaniappan, Mr. Naveen Hariharan, Mr. Naren T Kesh, Ms. Vidhyalakshimi S and Prof. Angel Deborah S worked on home automation with five technologies, GSM, Bluetooth, Phone control, Zigbee and radio based wireless. Each of the five models was effective but none of them was fully automatic, a user had to control everything manually using those technologies. There was no concept of measurement of the need of light or fan.

Proposed architecture A. Components Require

1. Arduino Uno

2. DIR motion detector sensor

3. D6T-44L thermal sensor

4. NTC temperature sensor

5. BH1750 light intensity sensor

6. HC-05 Bluetooth module

7. Android phone for manual control

8. Android app

1. Two PIR motion sensor is installed one after another on the door of the classroom, say PIR 1 and PIR 2. PIR 1 is on the outer side of the door and PIR 2 is on the inner side of the door.

2.If detection of motion is PIR 1 $\square$ PIR 2 that means at first PIR 1 detects an object and then PIR 2 detects an object then the main Arduino connected to them will increase a variable initialized as 0 by 1, this action will be taken as an entry. Let the variable count, where count==0 means no one is inside count != 0 means the room is not empty. The value of count at a time is the total number people inside the room at a time.

3.Now if count != 0 then the main Arduino will switch on all the D6T sensors.

4.If any of the D6T thermal sensors detects any human present in it's 4x4 matrix range it will send a signal to the main Arduino and the main board will switch on the NTC temperature sensor and the BH1750 light intensity sensor.



5.If the measurement of temperature sensor is greater Than the maximum limit then the main Arduino will turn on the fan controlling Arduino

6. If the light intensity sensor detects the light intensity lower than the minimum given value then the light controlling Arduino will be turned on.

7.The location of the human will be sent to the fan and light controlling Arduinos by the D6T sensor through the main Arduino.

8. The controlling Arduinos then will turn on the nearest light or fan from that location sent by the D6T sensor.

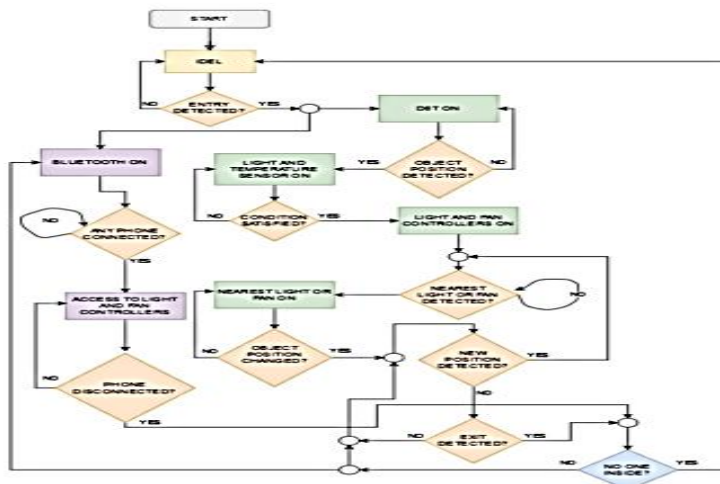
9. If the position of the human changes then the lights and fans of the previous location will be turned off and both will be turned on in the new location.

10. If the light intensity sensor detects presence of enough light from outer source then it will send a signal to main board and the main board will switch off the light controlling Arduino.

11. Same for the temperature.

12. If no human is in the range of any of the D6Ts then the fan & light controlling Arduinos will be turned off.

13. If detection of movement is PIR 2 $\square$ PIR 1 that means someone leaving the room, then the variable count will be decreased by 1. This will be an exit detection. When the value of the variable count becomes 0 then the main controller will switch off all the other parts except PIR motion detector.



Manual:

1. When the PIR motion detector detects the first entry movement then the main controller switches on the Bluetooth module.
2. Anyone inside the room can connect with the system by the Bluetooth through the android app on their phone.
3. All the light and fan in the room with their position map will be updated in the app automatically.
4. Then the user can control any of the item manually through the phone.
5. The user will get the priority over the automatic system.
6. But in case of the user forgets to turn off anything then the system will take care of it.

Advantages

1. This system will low down the wastage of electricity in Institutions.
2. By this system every electric product inside a class room can be controlled both automatically and manually.

3. This system will keep track of all the devices inside the room so that if someone forgets to turn off anything the system will take care of it.
4. The system will keep track of the exact position of the human inside even when he not moving and only the nearest lights or fans will turned on if condition satisfies.
5. It will also keep track on number of human entering and exiting from the room.
6. It can also differentiate human and non-human entries.

1.Arduino :

Arduino's processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data

Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button

Power Jack: Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied externally through the pin VIN or by giving voltage reference through the IOREf pin.

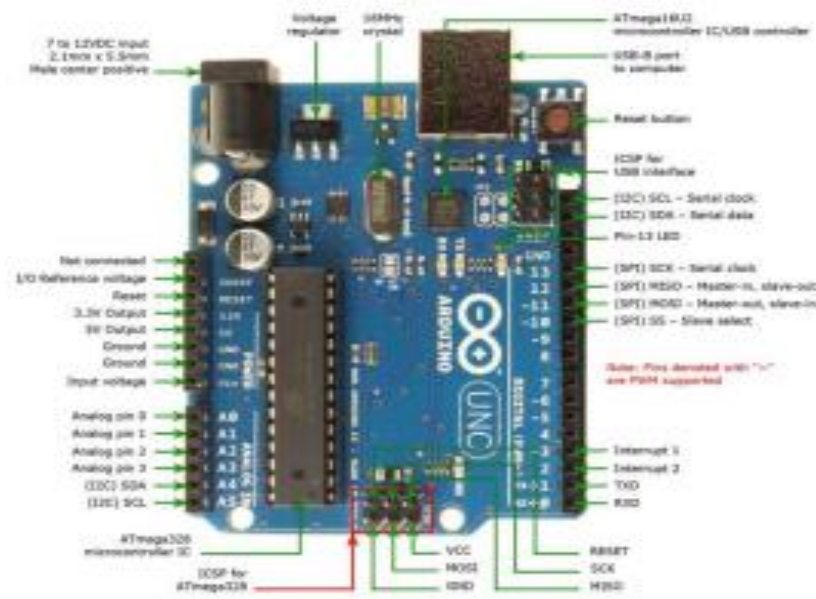
Digital Inputs: It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively, for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

AREf: It provides reference to the analog inputs

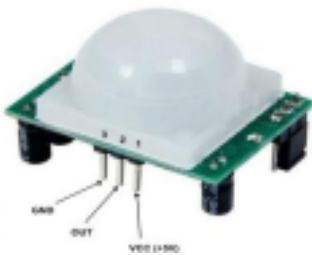
Reset: It resets the microcontroller when low.

Memory: The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.

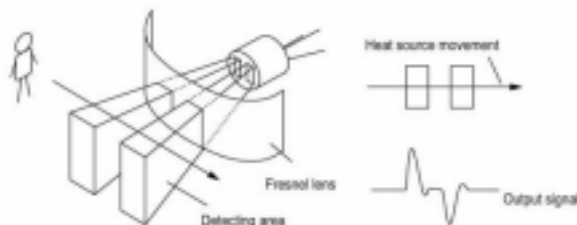


2. PIR motion detection sensor:

PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m. PIR are fundamentally made of a pyro electric sensor, which can detect levels of infrared radiation. For numerous essential projects or items that need to discover when an individual has left or entered the area. PIR sensors are incredible, they are flat control and minimal effort, have a wide lens range, and are simple to interface with.



PIR Sensor



D6T-44L thermal sensor

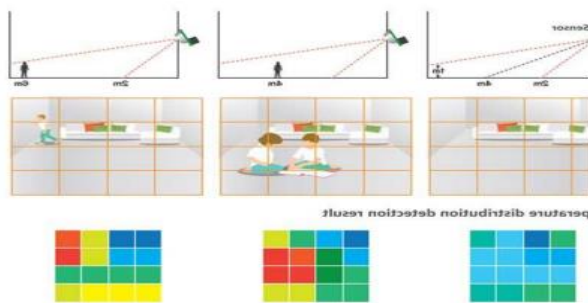
3. D6T-44L thermal sensor

Structure The D6T series sensors are made up of a cap with silicon lens, MEMS thermopile sensor chips, and dedicated analog circuit and a logic circuit for converting to a digital temperature value on a single

Operating principle

The non-contact temperature sensor measures the surface temperature of an object. D6T -44L -06 and D6T-8L-06 have sensor chip arrays of 16 channels

(4x4) and 8 channels (1x8) respectively. By mounting the signal processing circuit closely to the sensor chip, a low noise temperature measurement is realized. The module can also be used for detecting the presence of human beings. Omron's non-contact temperature sensor can solve the shortcomings of a conventional pyroelectric sensor, which cannot catch the signal of a stationary person because the sensor detects the change of signal [in principle]. Moreover, Omron's non-contact temperature sensor keeps detecting the far-infrared ray of an object, while the pyroelectric models do not.



4.NTC temperature sensor

NTC Thermistor temperature sensor module is low cost, small size module. It is very sensitive to ambient temperature. It is generally used to detect the temperature of the surrounding controller to detect high and low, by detecting temperature changes in the environment. The temperature detection range of the module is between 20 and 80 degrees Celsius. This module can be replaced with a line

temperature sensor for controlling the water temperature, water tank, etc. Generally the 4 wire method of thermistor measurement is the most accurate, because there is effectively no current flowing in either of the measurement cable wires and therefore no added resistance due to the cable wires.



5. BH1750 light intensity sensor

This is a BH1750 light intensity sensor breakout board with a 16 bit AD converter built-in which can directly output a digital signal, there is no need for complicated calculations. This is a more accurate and easier to use version of the simple photo resistor which only outputs a voltage that needs to be calculated in order to obtain meaningful data. With the BH1750 Light Sensor intensity can be directly measured by the lux meter, without needing to make calculations. The data which is output by this sensor is directly output in Lux (Lx). When objects which are lighted in homogeneous get the 1 lx luminous flux in one square meter, their light intensity is 1lx



Conclusion & future scope:

With this system one classroom can be made fully automatic. It will control the electronic device in a room on basis of human presence so even when someone forgets to switch off something it will switch off that particular device. The main strength of this device is that it can work both with and without human interaction. With its implementation we can decrease the wastage of electricity in a large number. It can come out as a energy saving mechanism in intuitions. In future with help of some biometric sensors and IoT we can also create an automatic attendance calculating mechanism with this proposed device.

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