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Development of an IoT-based Fan Speed Control System.

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Abstract: Nowadays there are various requirements of human being in which Internet of Things play an essential role in its application such as smart home, industrial internet, healthcare and security systems, smart cities, etc. Internet of Things (IoT) has attracted attention from both academic and industrial worlds. IoT is a concept describing a vision in which everyday objects are connected to the Internet, are identified, and communicate with each other. IoT makes the operation of devices easy and comfortable using mobile devices in controlling the electronic devices such as Fan, electric bulb etc., making it smart and easy to access. The advancement in technology brings about the IoT in creating a smart environment. In this design, the IOT has been configured as access point with its own SSID and Password which enables it to connect to any available configured mobile phone to send data to database. When signal is being sent from mobile app then IOT ESP8266 microcontroller receives the signal through internet connection and interprets the code and sends command to the Fan. The android mobile phone receives data from real time database through the firebase secret key address and URL linked with mobile app to entrench communication. The mobile app controls the Fan speed through the buttons in the app. The purpose of this research is to develop an IoT- based Fan Speed Control System using an android mobile phone.

Keywords: Internet of Things, Android mobile phone, ESP8266 microcontroller, smart devices, Fan speed.

1.0 Introduction

Home automation is the use of technology and smart devices to control and automate various household functions .It allows homeowners to remotely manage and control appliances, through mobile app with enhanced convenience, comfort, security and energy efficiency within home.[1].On the other hand, Internet of Things(IoT) refers to the interconnection of physical devices and objects to the internet allowing them to collect data and exchange data. The aforementioned devices often embedded with sensors and network relatedness, can liaise with each other and with humans, making it possible to remotely track, manage and maximize their functions[2].IoT guarantees that independent can connect the appliances without any stress to be present in a specific place to bargain with a certain appliance[3].Dissimilar IoT-based appliances are utilized to decrease the time loss by permitting the end user to carry out an operation on the appliance(s) from somewhat remoteness without any hold up.[4].An automation technology advancement has improved the well-being of human, enjoyable, and relaxed in all division[5].IoT appliances account for a huge number of appliances that can keep track and command non-identical physical quantities[6].

This research work proposes an IoT- based Fan Speed Control System in conjunction with mobile app. Fan Speed Control System using IOT and mobile app has the capability to monitor and control the speed of Fan of three channels through the use of latest technology without direct human intervention. the device maintains the speed according to the target speed option selected from mobile app. Fan speed control system circuit is built around IOT.

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Microcontroller, Android App and a 3 channels relay board. IOT has capability to control the Fan speed anywhere in the world.

2.0 Literature Review

Automated Technology is now the toast of a large number of reseachers engaged in dissimilar methodologies to realize their objectives.

Md Mozasser Rahnan et.al. advanced a smart Fan that works based on the existence of human ambient temperature

and location of human.

S. Shimamura et.al. laboured on smart Fan robot that naturally locates and traces a person using thermal camera and RGB-D camera.

M.A.A. Mashud et.al. ran separate experiments and deduced that the Fan speed can be checked by room temperature using PT-100 sensor.

Vaibhav Bhatia and Gavish Bhatia employ Pulse Width Modulation (PWD) technique to control the Fan speed by interchanging the duty cycle akin to room temperature.

Suchart Yammen et.al. also examine an automatic Fan control using PIC microcontroller with a particular item known as Buzzer to bring about alarm when the temperature is over heated

3.0 Methodology

3.1 The developed IOT-based Fan Speed Control System consists of the hardware section and software section. The hardware section consists of the power segment, control segment and output segment which are discussed below.

Power segment: It describes how D.C 5V is obtained from A.C voltage and supply to the circuit.
Control segment: This explains how the microcontroller executes all lines of codes to send message to cloud and control the speed of the Fan automatically.

Output segment: It is the changing of the Fan speed that shows the output result.

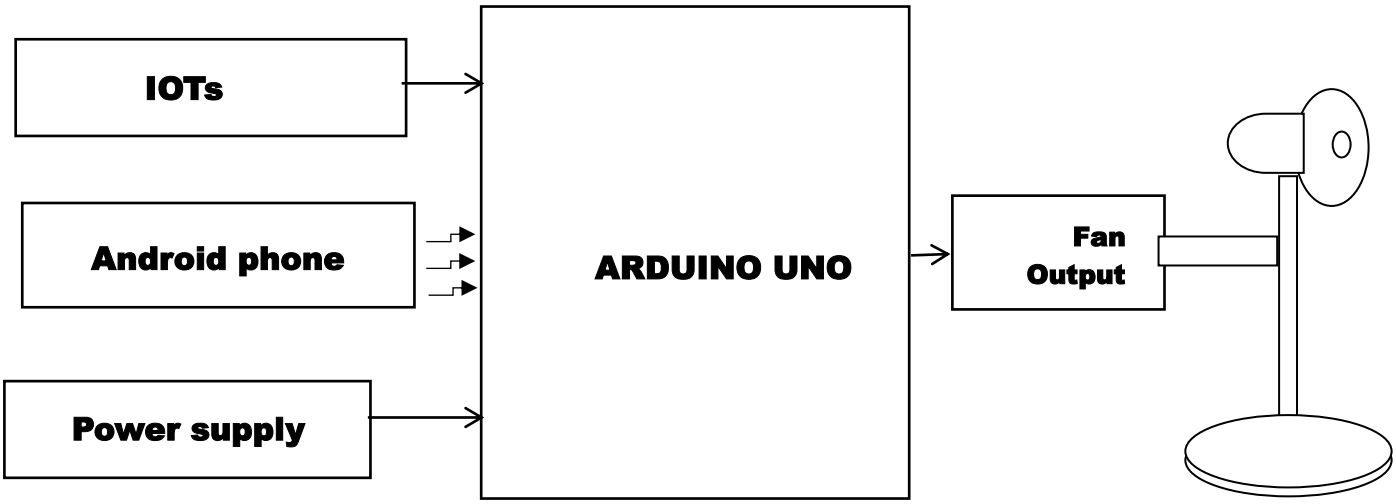

Fig. 3.1: Block diagram of IOT Fan Speed Control System

3.2 Other hardware module

Other hardware module includes various components joined together to form complete system such as Power supply and system circuit connection.

3.2.1 Power Supply

The system requires Power source of +5V and +12V D.C. One technique to generate +5V and +12V D .C is either from D.C battery or rectified A.C via diodes to produce continuous Power supply. In this research work, method of rectifying A.C voltage is used. To obtain +5V and +12V D.C from the mains 220V A.C, it requires the use of 12V step down transformer and convert it from alternating current to pulsating direct current, using diodes arranged in square. A smoothing filter (usually a capacitor) is used to remove the ripples to pure D.C voltage. The voltage is regulated using 7805 and 7812 voltage regulators to ensure constant +5V and +12V D.C supply to the circuit, as shown in figure 3.1 below.

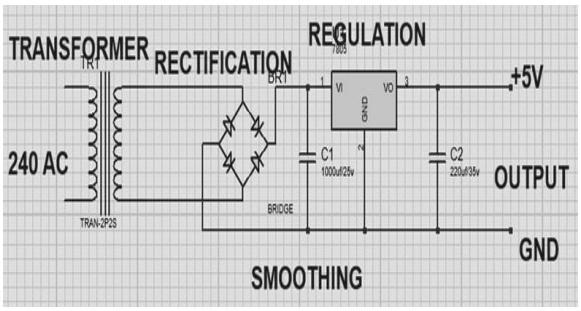

Fig. 3.1: Power supply (Silva et al, 2017)

It consists of different stages such as transformer stage, rectification stage smoothing stage and regulating stage
Transformer - The transformer stage steps down 240V A.C to 12V A.C.
Rectifier -The rectification stage rectifies 12V A.C to 12V D.C, but in this case the D.C output is not up to 12V D.C because some of the voltages will drop across the diode, approximately 10.85V D.C will be generated.
Smoothing - The smoothing stage takes place immediately to remove ripple/noise from the signal.
Regulator - The regulation stage regulates 12V D.C to 5V D.C required by system components. Regulated 5V D.C Power supply to the design.

3.3 System Circuit Diagram Connection.

ESP8266 positive terminal is connected to the positive of Power supply while the GND pin of ESP8266 is also connected to the GND of Power supply. The output of corresponding D5, D6, D7 and D8 of ESP82266 was connected to the base of 2n2222 transistor through 1k ohms while the collector pin connected to the 12V relay and each relay is connected to individual port of the Fan.The emitter of 2n2222 is connected to the ground source.

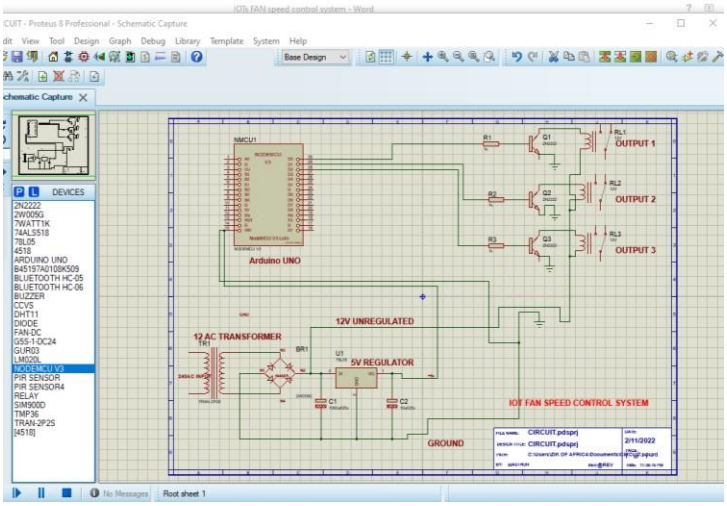

Fig. 3.2: Circuit Diagram of IOT Fan Speed Control System

3.4 System Description and Operation

IOT Fan Speed Control Systems is huge, sensitive, and reliable systems. Hence, the key reason that makes such systems considerably wanted to be available is to create stress free wireless operation. The system controls speed operation of the Fan, the system is a stand-alone device that is ready to receive signal wirelessly. The prosperity and the superiority of IOT microcontroller have played a great role in this research work. In this work, IOT microcontroller was programmed to accept signal from android app and it interprets the signal and sends the output result to respect Fan port to control it.

3.5 Principle of Operation

When the system is powered from the switch, the regulated 5V supplies power to the ESP8266 and the sensors. The, written program executes to initialize the whole system and operation commenced.. In this design, the IOT has been configured as access point with its own SSID and Password which enables it to connect to any available configured mobile phone to send data to database. When signal is being sent from mobile app then IOT microcontroller receives the signal through internet connection and interprets the code and sends command to the Fan

The android mobile phone receives data from real time database through the firebase secret key address and URL linked with mobile app to entrench communications. The mobile app controls the Fan speed through the button in the app.

3.6 Software Development

The software development is divided into two parts in this project viz mobile application using MIT inventor and arduino C programming for IOT. C language as programming language is used to program IOT microcontroller for receiving and sending the reading data to the cloud while MIT inventor is used to write mobile app to receive data from cloud.

3.7 Development of the User Interface

The software implementation also includes the development of the user interface. The user interface is a graphical interface where the system user interact with the system. This development was done using MIT Inventor.

MIT Inventor is online android application development that assists in designing android app, it consists of different components which aid in the design. It contains block of codes in dragging manner that is, drag and drop to arrange block of codes as shown in figure below.

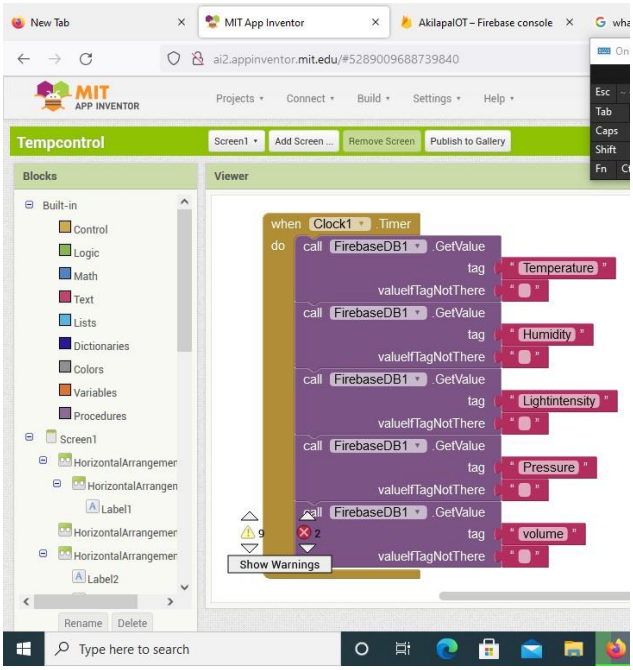

Fig.3.3: MIT Inventor

3.8 Microcontroller Embedded Language Development

The source code of this work is programmed in Arduino integrated development environment (IDE) and compiled. The hex file is loaded in microcontroller's Flash memory. The microcontroller executes the hex file generated by the compiler. The executable code comprised sequence of zeros and ones organized in 12-, 14- or 16-bit wide words, depending on the microcontroller's architecture. Every word is considered by the CPU as a command being executed during its operation. For practical reasons, as it is much easier to deal with hexadecimal number system, the executable code is often represented as a sequence of hexadecimal numbers called a Hex code. As for Arduino microcontrollers, programming word comprised 14 bits wide. The main advantage of C languages is its simplicity, it is no longer possible to know exactly how each command executes when using C compiler. The snapshot of the Arduino compiler window is shown below;

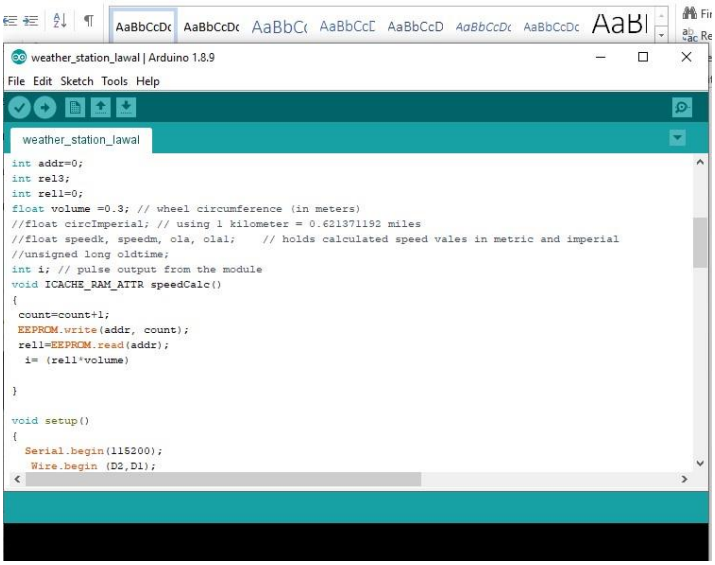

Fig. 3.4: Arduino Code Interface

4.0 Results and Discussion

4.1 System Testing

Testing is a vital process in the development and realization of any design, be it hardware-based, software-based or both. The various components and their circuitry have to be tested to ensure that all the components on board are certified okay . The components that did not give the required output specification were isolated and troubleshooted to determine the nature and cause of the component failure through careful analysis of the working principles of the component(s). Also, during the testing analysis, modularization and Interface design were also tested. Each module in case of the software was tested to know whether it performs the functions assigned to it and also to know whether each of the modules can interact as required by transferring and returning data in form of a signal.

4.2 Unit testing

This is the process of testing each of the circuits separately and each stage involved to know whether they are fit for use in the design before everything is coupled together.

4.3 Experiment test

This aspect depicts snapshot of various stages involved in the design and also shows various tests each stage undergoes for achieving the aim and the objectives of the design.

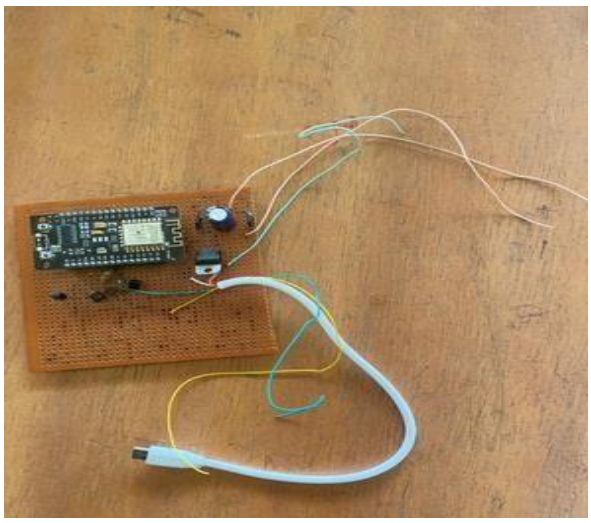

Fig. 4.1: Image of ESP8266 and Power Section

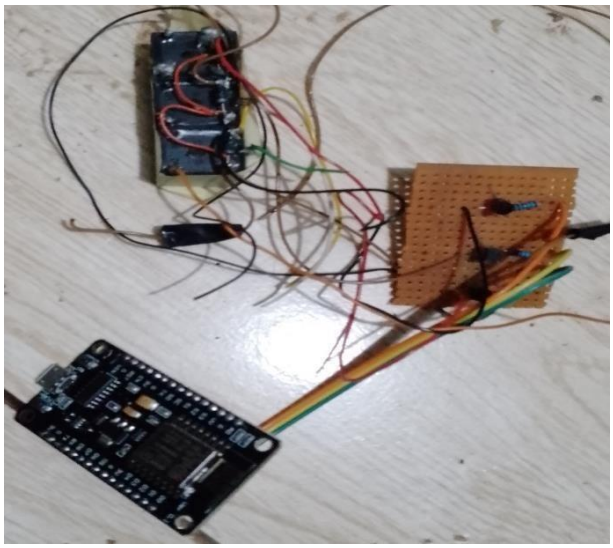

Fig.4.2: Image of ESP8266 with Buffer and Relays

Fig.4.3: Image of the Coupled System

Conclusion

In conclusion, IOTs Fan Speed Control has been experimentally proved to work satisfactorily. The system was successfully tested in a well-ventilated environment, thus proving its portability and wide compatibility. Internet of things (IOT) was successful in fetching data from sensors i.e. ESP8266 executes lines of codes. The data from each of the sensors sent to the open-source database isused to store data at regular intervals. Thus, IOT Fan Speed Control was successfully designed, tested and implemented.

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