INDUSTRIAL DEVICE CONTROL USING ANDROID MOBILE & BLUETOOTH TECHNOLOGY

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ABSTRACT

Android is open source software, manufacturers can modify the operating system to suit their respective needs and phones. This becomes a cheap and feasible alternative for the manufacturer, as opposed to developing an operating system in industry, in-house or hiring a software company to do it. The Android platform includes support for the Bluetooth network stack, which allows a device to wirelessly exchange data with other Bluetooth devices. The application framework provides access to the Bluetooth functionality through the Android Bluetooth . Here the proposed system is designed to controlling the speed of AC motor using android application where the remotely controlling speed of AC motor is achieved. Android mobile act as a transmitter and the received by Bluetooth receiver interfaced to PIC microcontroller . Each time data is sent by android application as per code written is executed by PIC to deliver supply signal to triac through optical isolation. Hence the power to load connected in series with triac is controlled based on received signal and speed control of AC motor is achieved.

This project has integration of Android mobile technology and embedded system. Android mobile user has to install an application on his/her mobile handset to control the devices. For example turn on AC Motor, Turn off AC Motor, turn on Fan, Turn off Fan. Turn on Light , Turn off Light etc. Such that by giving commands from mobile you can control industrial work.

Keywords-:PIC microcontroller, Bluetooth module, Motor Driver, AC motor, Hall effect sensor, temperature sensor, Android mobile phone, power supply.

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1 .INTRODUCTION

For the improvement of quality product many industrial application requires adjustable speed and constant speed. Due to rapid advance in automation and process control the field of adjustable speed drives continuously. In recent technology, various alternate techniques are available for the selection of speed of drive system. Up to the 1980"s the dc motor was the choice for variable speed drive application. Induction motors are using any application such as Industrial drives control, automotive control, etc. In past few years there has been a great demand in industry for adjustable speed drives. Fan, pump, Compressors, domestic applications and paper machines etc... In this area DC motor was very popular but having many disadvantages so that microcontroller transformed research and development toward control of ac drive.

When the three phase supply is not available for domestic and commercial application, there we are using single phase induction motor which is one of the most widely used type of low power motor in the world An induction or asynchronous motor is a type of AC motor where power is supplied to the rotor by means of electromagnetic induction, rather than by slip rings and commutator as in slip-ring AC motors. It has a squirrel-cage rotor identical to a single phase and 3-phase motor winding on the stator. There are various methods for

controlling the speed of AC motors. There are several of method is available for speed control of ac motor one of the method is two vary frequency and voltage of motor. Speed modulation of a single-phase motor is usually achieved either by some electrical means, such as reducing supply voltage by auto-transformer, or by switching windings to change the number of motor poles for different operating condition as required.

For changing the speed of capacitor run motor voltage control is best method, but it allows only limited speed range to be obtained. Now frequency acts as interesting alternative to voltage control.

The most appropriator actuators for variable speed drive is seem to be capacitor run drive. In our project the speed of induction motor, control with the help of android apps that comes under wireless technology. Android application use here as a transmitter and remote control in order control the speed of induction motor with the help of Bluetooth as a receiver.

This project has integration of Android mobile technology and embedded system. Android mobile user has to install an application on his/her mobile handset to control the devices. Then he/she can give command using the buttons on that application. For this you have to turn on the Bluetooth on mobile, so the main wireless controlling technique used in this project is Bluetooth technology. Bluetooth receiver will be connected to the project. This Bluetooth device is connected to the circuit which has a decoder. It sends out a code for respective command sent by user. Then the respective device connected to the circuit will be turned on or off depending on the command give. For example Turn on AC Motor, Turn off AC Motor, Turn on Fan , Turn off Fan. Turn on Light , Turn off Light etc. Such that by giving commands from mobile you can control industrial work.

This is more advantages, when we have to turn on the machinery at the time when we have another urgent task to do and we cannot get up from our place. In this case we can turn on machinery by giving simply command through mobile phone. There is no need to go to field.

1. LITERATURE SURVEY

1.1 Advance Home Automation Using FPGA Controller

In this paper, author introduced a new technology with Field Programmable Gate Array (FPGA) controller, Bluetooth and Android phones. It is wireless technology. VHDL language is used for a Xilinx Spartan-3E. V means VHSIC (Very High Speed Integrated Circuit). FPGA Controller is based on Basys2 development board. FPGA has a many input and output pins so it can connect number of home equipment's. FPGA is used for controlling home equipment's. Bluetooth is used for monitoring equipment by wireless technique. Android phone is used for speech recognition. DC motor, stepper motor, a LED are connected to FPGA. A microcontroller has less number of input and output pins than FPGA Controller. Main aim of this paper is to increases the speed using parallel communication. [1]

1.2 GSM Based Home Automation System Using App-Inventor for Android Mobile Phone

In this paper, author introduced Home automation based on GSM system using App-inventor for Android mobile. In App inventor, programmer has to design different blocks than design the source code like in LabVIEW software. Programming is not essential. The main aim of this paper is to have ease in programming using App inventor and security using GSM. App inventor is a platform to design a new smart phone apps using android. User has to login first online then start to design both part the screen objects (Designer) and the programming logics (blocks). User can control home equipment using GSM by each corner of world. In hardware, ULN2803 octal peripheral driver array, ATMEGA328 Arduino board with microcontroller, GSM Modem, Relay and some other small components are used. Arduino board worked as a transceiver. It has 23 I/O lines. In this paper hardware and software part is done individually. [2] ***Bhadane et al., International Journal of Advanced Research in Computer Science and Software Engineering 5(2), February - 2015, pp. 419-421 © 2015, IJARCSSE All Rights Reserved Page | 420***

1.3 Android Based Appliances Control System

In this paper, controlling fan speed and light intensity is specialty of the project. This paper hold two parts, hardware part called process unit and software part called monitoring unit. Process unit contain Bluetooth module LM400, LCD, dimmer circuit, and microcontroller PIC16F877 (40 pin IC). Monitoring unit contain only smart phone. For better efficiency dimmer circuit is designed using SCR. Home appliances can control using android phone which has Bluetooth application. Bluetooth module is used for communication. It is wireless technology.

1.4 Bluetooth Based Home Automation and Security System Using ARM9

In this paper, the two microcontroller development boards viz ARM 7 and ARM 9 were used. ARM 9 (S3C2440A) is in transmitter side and ARM 7 (LPC2148) is in receiver side. Operating system Wince6.0 is used for designing the application on ARM9. In hardware parts ARM7, ARM 9, ULN2003, Relays, Bluetooth module are used. VB.NET is used for designing apps. Graphical User Interface module and Serial Port Profile modules are used in software part. Bulb, fan is controlled using Bluetooth, ARM – MDK kits acts as a processor. It is cost effective project.

1.5 Efficient Interactive Control System based on GSM

In this paper, author introduced GSM technology with AT89S52 microcontroller. Simulation software is Proteus v7.7 and Keil compiler used for embedded C programming. Prime aim of this project is if in future any accident will happen then system will send SMS messages to the user. At any time, user can send request for condition of system. Home appliances can be control using SMS service means GSM so user can save his/her money and time. In proposed system, power supply gives 5V power to the system. AT89S52 is 8- bit, low cost controller. MAX232 is used for conversion of signal. Relay driver ULN2003 drives the all relays which connected to the loads. Last but not the least GSM module SIM300 is messenger between the user and microcontroller using AT command. This paper gives detail information about circuit diagram in Proteus simulation diagram and all necessary components.

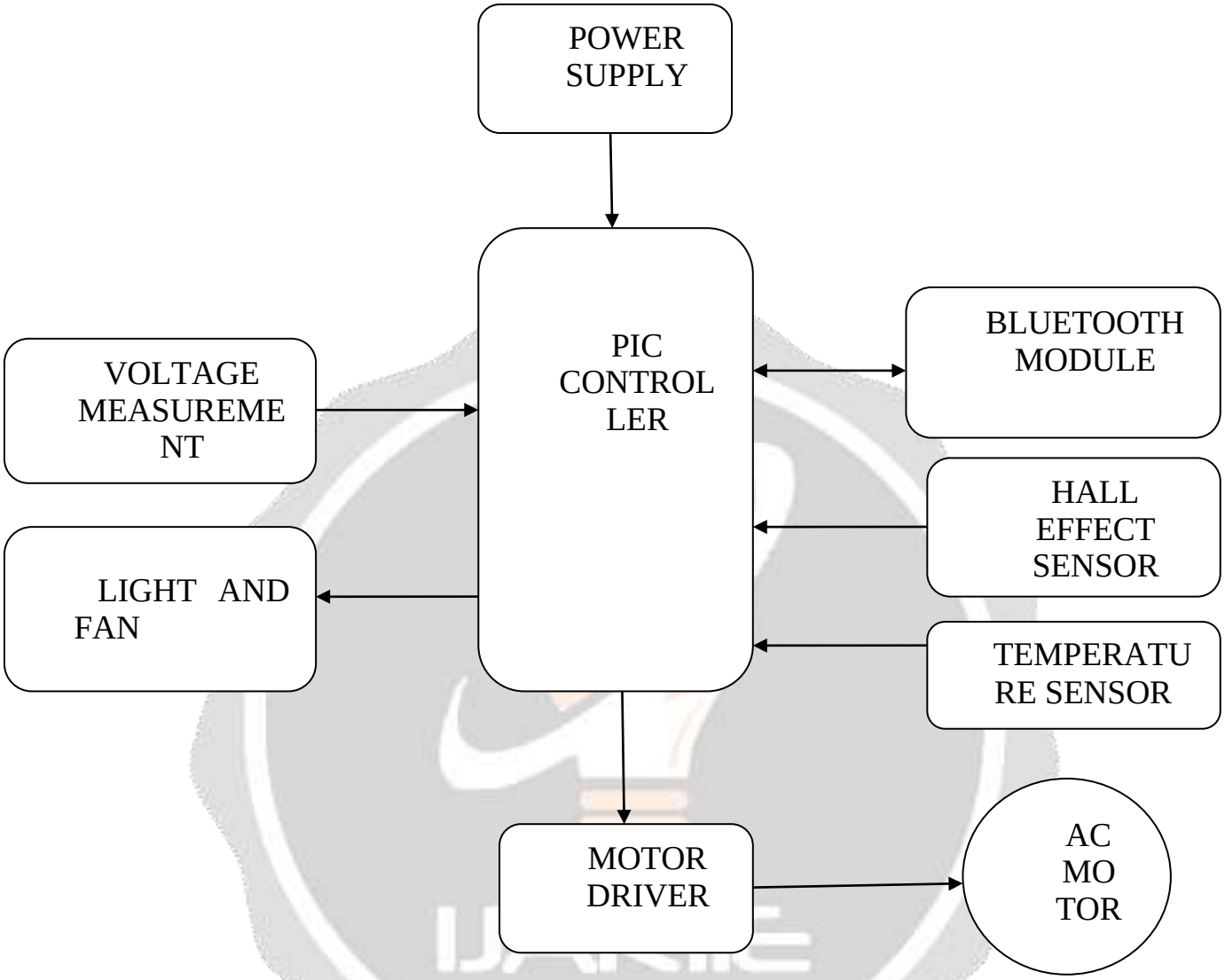
2. EXISTING SYSTEM

This project for industrial device control purpose application, some past time when this system not use in industries . some past time industrial device control system using wired and switch are used.

3. PROPOSED SYSTEM

1. To control the speed of the single phase AC motor using wireless Bluetooth Technology
2. To control the speed of the single phase AC motor using limited power supply.
3. To facilitate the flexible control of the speed of single phase AC induction motor used in industries.
4. Along with speed control, it also gives feedback for temperature rise.
5. To detect the over voltage and low voltage and indicates in mobile phone as well as in the kit display.

4.SYSTEM ARCHITECTURE : Transmitter and Receiver



The different blocks in the system are:-

4.1 Micro controller:

PIC16F877 (or PIC16F87X: PIC16F873, PIC16F874, PIC16F876 and PIC16F877), one of the microcontroller made by **Microchip Inc.**. There are many families for the PIC microcontroller, the PIC16F877 is the PIC16 family. PIC16F877 is one of the most commonly used microcontroller especially in automotive, industrial, appliances and consumer applications.

The PIC16F877 is a RISC (*Reduced Instruction Set Computer*) Microcontroller, which gives two great advantages:

- The CPU only recognizes 35 simple instructions. Just to mention that in order to program other microcontrollers in assembly language it is necessary to know more than 200 instructions by heart.
- The execution time is the same for almost all instructions, and lasts for 4 clock cycles. The oscillator frequency is stabilized by a quartz crystal. The execution time of jump and branch instructions is 2 clock cycles. It means that if the microcontroller's operating speed is 20MHz, the execution time of each instruction will be 200nS, i.e. the program will execute 5 million instructions per second!

The PIC16F87X Microcontroller Core Features

- High performance RISC CPU
- Only 35 single word instructions to learn
- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input, DC - 200 ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory,
  Up to 368 x 8 bytes of Data Memory (RAM)
  Up to 256 x 8 bytes of EEPROM Data Memory
- Pinout compatible to the PIC16C73B/74B/76/77
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack
- Direct, indirect and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low power, high speed CMOS FLASH/EEPROM technology
- Fully static design
- In-Circuit Serial Programming (ICSP) via two pins
- Single 5V In-Circuit Serial Programming capability
- In-Circuit Debugging via two pins
- Processor read/write access to program memory
- Wide operating voltage range: 2.0V to 5.5V
- High Sink/Source Current: 25 mA
- Commercial, Industrial and Extended temperature ranges
- Low-power consumption:
  - < 0.6 mA typical @ 3V, 4 MHz
  - 20 μA typical @ 3V, 32 kHz
  - < 1 μA typical standby current

The PIC16F87X Microcontroller Peripheral Features

- **Timer0**: 8-bit timer/counter with 8-bit prescaler
- **Timer1**: 16-bit timer/counter with prescaler, can be incremented during SLEEP via external crystal/clock
- **Timer2**: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- **Two Capture, Compare, PWM modules**
  - Capture is 16-bit, max. resolution is 12.5 ns
  - Compare is 16-bit, max. resolution is 200 ns
  - PWM max. resolution is 10-bit
- **10-bit multi-channel Analog-to-Digital converter (ADC)**
- Synchronous Serial Port (**SSP**) with **SPI** (Master mode) and **I2C** (Master/Slave)
- Universal Synchronous Asynchronous Receiver Transmitter (**USART/SCI**) with 9-bit address detection
- Parallel Slave Port (**PSP**) 8-bits wide, with external RD, WR and CS controls (40/44-pin only)
- **Brown-out detection circuitry** for Brown-out Reset (BOR)

4.2 Regulated power supply:

Introduction:

Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

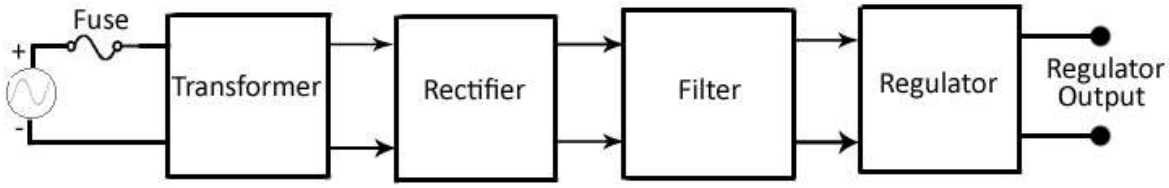


Figure 1-1 Block diagram of a power supply

The components mainly used in above figure are

- 230V AC MAINS
- TRANSFORMER
- BRIDGE RECTIFIER(DIODES)
- CAPACITOR
- VOLTAGE REGULATOR(IC 7805)
- RESISTOR
- LED (LIGHT EMITTING DIODE)

The detailed explanation of each and every component mentioned above is as follows:

Transformation:

The process of transforming energy from one device to another is called transformation. For transforming energy we use transformers.

Transformers:

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors without changing its frequency. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core, and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the secondary winding. This effect is called mutual induction.

Rectification:

The process of converting an alternating current to a pulsating direct current is called as rectification. For rectification purpose we use rectifiers.

Rectifiers:

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid-state diodes, vacuum tube diodes, mercury arc valves, and other components.

A device that it can perform the opposite function (converting DC to AC) is known as an inverter. A capacitor will pass alternating current but (apart from an initial surge) it will not pass DC.

Regulation:

The process of converting a varying voltage to a constant regulated voltage is called as regulation. For the process of regulation we use voltage regulators.

Voltage Regulator:

A voltage regulator (also called a 'regulator') with only three terminals appears to be a simple device, but it is in fact a very complex integrated circuit. It converts a varying input voltage into a constant 'regulated' output voltage. Voltage Regulators are available in a variety of outputs like 5V, 6V, 9V, 12V and 15V. The LM78XX series of voltage regulators are designed for positive input. For applications requiring negative input, the LM79XX series is used. Using a pair of 'voltage-divider' resistors can increase the output voltage of a regulator circuit.

It is not possible to obtain a voltage lower than the stated rating. You cannot use a 12V regulator to make a 5V power supply. Voltage regulators are very robust. These can withstand over current draw due to short circuits and also overheating. In both cases, the regulator will cut off before any damage occurs. The only way to destroy a
regulator is to apply reverse voltage to its input. Reverse polarity destroys the regulator almost instantly.

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Resistors:

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current passing through it in accordance with Ohm's law.

Ohm's law:

The behavior of an ideal resistor is dictated by the relationship specified in Ohm's law:

$$V = IR \quad \ldots\ldots (1)$$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I) through it where the constant of proportionality is the resistance (R).

Power dissipation:

Power dissipated by a resistor (or the equivalent resistance of a resistor network) is calculated using the following:

$$P = I2R = IV = V2/R \quad \ldots\ldots (2)$$

4.3 Bluetooth module:

The ' Bluetooth ' is the short-range radio link technology designed to "connect" an array of devices including mobile phones, PCs and PDAs. In our project we are using HC – 06 Bluetooth module. In our project Bluetooth module is used in the motor drive circuit to connect with Android mobile phone by the help of Android application.

Fig 3.5 Bluetooth module

Bluetooth module specifications:

HC – 06 with serial port module.

Bluetooth number: JY-MCU-HC-06, surface mount with integrated antenna.

Operating Voltage: 5 volt, reduced to 3.3 volts, @ 8 mA.

Default baud rate: 9600 bps.

4.4 Hall Effect Sensor

In this project the hall effect technique is used to control the speed of the motor.

Features:

- Non-contact switching
- Digital output signal
- Large operating temperature range from -40° F to 300° F
- Wide operating voltage range from 6 to 24 VDC
- Omnipolar sensing
- Vibration tolerant
- RoHS compliant

Specifications:

- Digital Output Hall Effect Sensor Type : 3 wire, sinking signal (NPN)
- Supply Voltage Range : 6-24 VDC
- Supply Current : 3.5 mA
- Output Voltage : 6-24 VDC (Corresponds with Supply Voltage used)
- Output Current :Output capable of sinking 25 mA
- Magnetic Pole Detect : North and South
  - (Positive and Negative field)
- Gap : 1/16" to 1/2" (determined by magnetic field strength on target)
- Frequency : 25 kHz Maximum
- Sensor Housing Material : Aluminum
  Delrin for corrosive environments

4.5 LM35 Sensor

In this project the LM35 is used to control the temperature of the motor.

Features

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications
- Low-Cost Due to Wafer-Level Trimming
- Operates from 4 V to 30 V
- Less than 60-µA Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

4.6 AC Motor

An induction or asynchronous motor is an AC electric motor in which the electric current in rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor as found in universal, DC and synchronous motors. An induction motor's rotor can be either wound type or squirrel–cage type.

5. SYSTEM REQUIREMENT SPECIFICATION

5.1SOFTWARE REQUIREMENTS

- MICRO C FOR PIC for developing controller code.
- EXPRESS PCB for designing schematics.
- PICKIT2 for dumping the hex files into controller.
- Android studio for developing Android application

5.2HARDWARE REQUIREMENTS

- PIC Microcontroller.
- Temperature sensor.
- Zero cross detector
- Blue tooth module
- Regulated +5v Power supply.
- Android based mobile.

6. TECHNICAL SPECIFICATIONS

6.1ADVANTAGES

- Remote operation is achieved by any smart-phone /tablet etc. with android os.
- Technically expert controller is not required.
- Android app is an open source system to develop any programming code.
- Programming code is not always required to change for different input parameters.
- Bluetooth consumes less power so more preferable.
- More useful for the patient and disabled person.

6.2APPLICATIONS

- Machines controlling system in industry.
- Motor speed controlling systems, Light intensity controlling systems.
- Fan and light controlling in industry.
- Home automation

7. CONCLUSIONS

The objective of a project has been achieved which has been developing the hardware and software for controlling speed of induction motor using android application. The demand for wireless operating device increases, it is more preferable over wired devices. Here we are controlling speed of induction motor using Bluetooth and android application wirelessly.

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