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Review Paper on Healthcare Monitoring System

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Abstract- The proposed model enables users to improve health related risks and reduce healthcare costs by collecting, recording, analyzing and sharing large data streams in real time and efficiently. The idea of this project came so to reduce the headache of patient to visit to doctor every time he need to check his blood pressure, heart beat rate, temperature etc. With the help of this proposal the time of both patients and doctors are saved and doctors can also help in emergency scenario as much as possible. The proposed outcome of the project is to give proper and efficient medical services to patients by connecting and collecting data information through health status monitors which would include patient's heart rate, blood pressure and sends an emergency alert to patient's doctor with his current status and full medical information. In simple terms, i.e. "Smart" objects which use various sensors and actuators that are able to perceive their context, and via built in networking capabilities they could communicate to each other, access the open source Internet services and interact with the human world. This not only makes the world connected but also robust and comfortable. It consists of a system that communicates between network connected systems, apps and devices that can help patients and doctors to monitor, track and record patients' vital data and medical information. Some of the devices include smart meters, wearable health bands, fitness shoes, RFID based smart watches and smart video cameras. Also, apps for smart phones also help in keeping a medical record with real time alert and emergency services.

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I. INTRODUCTION

In a hospital health care monitoring system it is necessary to constantly monitor the patient's physiological parameters. This paper presents a monitoring system that has the capability to monitor physiological parameters from multiple patient bodies. In the proposed system, a coordinator node has attached on patient body to collect all the signals from the wireless sensors and sends them to the base station. The attached sensors on patient's body form a wireless body sensor network (WBSN) and they are able to sense the heart rate, blood pressure and so on. This system can detect the abnormal conditions, issue an alarm to the patient and send a data to the physician. Also, the proposed system consists of several wireless relay nodes which are responsible for relaying the data sent by the coordinator node and forward them to the base station. The main advantage of this system in comparison to of both patients and doctors are saved and doctors can also help in emergency scenario as much as possible. The proposed outcome of the project is to give proper and efficient medical services to patients by connecting and collecting data information through health status monitors previous systems is to reduce the energy consumption to prolong the network lifetime, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life. We have developed this system in multi-patient architecture for previous systems is to reduce the energy consumption to prolong the network lifetime, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life. We have developed this system in multi-patient architecture for hospital healthcare and compared it with the other existing networks based on multi-hop relay node in terms of coverage, energy consumption and speed.

II. LITERATURE REVIEW

Aging presents a series of challenges for the entire world population, primarily because seniors slowly lose their ability to be self-sufficient due to chronic diseases, physical and/or mental disabilities, or the general frailty that characterizes the aging process [2]. Any of these conditions represent factors that limit the elderly or endanger their lives, even within the confines of their homes. Consequently, 24-hour-a-day monitoring of the elderly can improve attention provided for chronic or acute health concerns, accidents such as falls, as well as a series of other conditions that can detrimentally affect the elderly. Additionally, non-fatal falls by the elderly can severely compromise quality of life and/or represent considerable medical expenditures (*i.e.*, in Finland $3,611 dollars per injury, in Australia $1,049dollars per injury) [3].

Providing remote healthcare monitoring and services presents a series of important challenges; therefore, it is important to generate remote monitoring strategies to

hospital healthcare and compared it with the other existing networks based on multi-hop relay node in terms of coverage, energy consumption and speed.

The proposed model enables users to improve health related risks and reduce healthcare costs by collecting, recording, analyzing and sharing large data streams in real time and efficiently. The idea of this project came so to reduce the headache of patient to visit to doctor every time he need to check his blood pressure, heart beat rate, temperature etc. With the help of this proposal the time of both patients and doctors are saved and doctors can also help in emergency scenario as much as possible. The proposed outcome of the project is to give proper and efficient medical services to patients by connecting and collecting data information through health status monitors which would include patient's heart rate, blood pressure and sends an emergency alert to patient's doctor with his current status and full medical information. In simple terms, i.e. "Smart" objects which use various sensors and actuators that are able to perceive their context, and via built in networking capabilities they could communicate to each other, access the open source Internet services and interact with the human world. This not only makes the world connected but also robust and comfortable. The Internet of things in the fieldof healthcare also plays a major role in providing ease to patients and doctors. It consists of a system that communicates between network connected systems, apps and devices that can help patients and doctors to monitor, track and record patients' vital data and medical information. Some of the devices include smart meters, wearable health bands, fitness shoes,RFID based smart watches and smart video cameras. Also, apps for smart phones also help in keeping a medical record with real time alert and emergency services.In an example of the application of this system is controlling a pregnant woman. A pregnant woman's blood pressure should be the same as any other person's normal blood pressure. It is important to monitor the blood pressure during pregnancy, to watch recording in case of children, elderly people and critical patients. Physical properties that canbe sensed include temperature, pressure, vibration, sound level, weight, flow rate of gases and liquids, etc. The smart sensors which can be worn by the patient connect to the master hub (Central Computer) of the doctor sitting at a distance using wireless information and communication technology (ICT) network. The features of this technique include portability and non-invasive nature resulting in non-interference with the day to day activities of the patients. This technology is advantageous in the regions having limited resources and situations where continuous emergent diagnosis is required.

The Punit Gupta presents the paper on design and implementation of an IOT-based health monitoring provide primary healthcare services and mechanisms that allow seniors to receive long-term assistance. To better meet the needs of the aging population, research has significantly advanced both the theory and application of e-Health technologies; largely because their application can reduce costs generated by patient monitoring and provide a variety of advanced services [4]. Importantly, studies show that the elderly generally accept e-Health technologies and consider them beneficial [3]. The Amit Laddi1, presents the paper in 2012, Body Area Network based Health Monitoring of Critical Patients: a Brief Review. This paper discusses recent techniques for the detection of physical, chemical and biological signals along with their measurement and stor-age, data mining and visualization. Compared with existing M-Health system, the MobiHealthcare system is character-istics of low coupling and powerful parallel computing capabilities[2]. Various healthcare applications have been implemented in the proposed system to demonstrate its effectiveness in providing a powerful platform[2].

The Media Aminian and Hamid Reza Naji presents the paper in 2013, A Hospital Healthcare Monitoring System Using Wireless Sensor Networks, In a hospital health care monitoring system it is necessary to constantly monitor the patient's physiological parameters. For example a pregnant woman parameters such as blood pressure (BP) and heart rate of the woman and heart rate and movements of fetal to control their health condition[1].

This paper presents a monitoring system that has the capability to monitor physiological parameters from multiple patient bodies[3]. In the proposed system, a coordinator node has attached on patient body to collect all the signals from the wireless sensors and sends them to the base station. The attached sensors on patient's body form a wireless body sensor network (WBSN) and they are able to sense the heart rate, blood pressure and so on. This system can detect the abnormal conditions, issue an alarm to the patient and send a SMS/E-mail to the physician. Also, the proposed system consists of several wireless relay nodes which are responsible for relaying the data sent by the coordinator node and forward them to the base station[4]. The main advantage of this system in comparison to previous systems is to reduce the energy consumption to prolong the network lifetime, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life[2]. We have developed this system in multi-patient architecture for hospital healthcare and compared it with the other existing networks based on multi-hop relay node in terms of coverage, energy consumption and speed. The Balakrishna D presents the paper, Mobile Wireless Sensor Networks: Healthcare in Hospitals in 2013, Wireless Sensor Networks (WSN) have attracted much attention in recent years. The

system for emergency medical services which can demonstrate collection, integration, and interoperation of IoT data flexibly which can provide support to emergency medical services like Intensive Care Units(ICU), using a INTEL GALILEO 2ND generation development board. The proposed model enables users to improve health related risks and reduce healthcare costs by collecting, recording, analyzing and sharing large data streams in real time and efficiently[3]. The idea of this project came so to reduce the headache of patient to visit to doctor every time he need to check his blood pressure, heart beat rate, temperature etc. With the help of this proposal the time of both patients and doctors are saved and doctors can also help in emergency scenario as much as possible. The proposed outcome of the project is to give proper and efficient medical services to patients by connecting and collecting data information through health status monitors which would include patient's heart rate, blood pressure and ECG and sends an emergency alert to patient's doctor with his current status and full medical information[3]. The Fen Miao and Xiuli Miao presents the paper on MobiHealthcare System: Body Sensor Network Based M-Health System for Healthcare Application in 2012, they are discusses about, M-health, which is known as the practice of medical and public health supported by mobile devices such as mobile phones and PDAs for delivering medical and healthcare services, is currently being heavily developed to keep pace with the continuouslyrising demand for personalized healthcare[1]. To this end, the Mobile Healthcare system, whichprovides a personalized healthcare based on body sensor network, is developed. The system includes various body sensors to collect physiological signals specifically for different requirements, a cell phone to facilitate the joint processing of spatially and temporally collected medical data from different parts of the body for resource optimization and systematic health monitoring, a server cluster with great data storage capacity, powerful analysis capabilities to provide data present novel ideas to improve healthcare systems in India with the help of telecommunication and information technology[1].

III. SYSTEM CONCEPT

The health monitoring system is intelligent enough to monitor the patientautomatically using RF that collects the status information through these systems which would include patient's heart rate, blood pressure, temperature and sends an emergency alert to patient's doctor with his current status and full medical information. This would help the doctor to monitor his patient from their cabin. This model can be deployed at various hospitals and Medical institutes. The system uses smart sensors that generates raw data information collected from each sensor and send it to a PC where the data can be further analyzed and statistically maintained

applications of Wireless Sensor Network are immense. Wireless Sensor networks have been used for various applications like environment monitoring, health monitoring and etc[2]. Applications of Wireless sensor network in healthcare leads to an area called Body Area Network (BAN) or Body sensor Networks[3]. In recent years we have witnessed that the wireless body area network technology is increasing pressure on quality of healthcare because of increasing population of aging people and health consciousness people. As a result Wireless body area networks are an emerging technology for providing this kind of health facility to the required people. In this paper we present an overview of wirelessbody area networks and we also

ARM-7 family. It is manufactured by Philips and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer.

FEATURES OF LPC214X SERIES CONTROLLERS

Fig. 1 IC LPC214X

• 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128bit wide interface/accelerator enables high speed 60 MHz operation.

• In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1ms.

• Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on chip Real Monitor software and high speed tracing of instruction execution.

• USB 2.0 Full Speed compliant Device Controller with 2 kB of endpoint RAM. In addition, the LPC2146/8 provides 8 kB of on-chip RAM accessible to USB by DMA.

• One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of 6/14analog inputs, with conversion times as low as 2.44 us per channel.

• Single 10-bit D/A converter provides variable analog output.

• Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.

• Low power real-time clock with independent power and dedicated 32 kHz clock input.

• Multiple serial interfaces including two UARTs

(16C550), two Fast I2C-bus(400 kbit/s), SPI and SSP with buffering and variable data length capabilities.

•Vectored interrupt controller with configurable to be used by the medical experts. Maintaining a database server is a must so that there is even track of previous medical record of the patient providing a better and improved examining. This system is also connected the emergency to each bed of hospitals whenever the user required the help they can press the button which alerts the ward boy with indication and alarm.

In an example of the application of this system is controlling a pregnant woman. Apregnant woman's blood pressure should be the same as any other person's normal blood pressure. It is important to monitor the blood pressure during pregnancy, to watch for preeclampsia. These women need frequent BP checks. If BP goes too high, the patient may be hospitalized. But, the patient is limited to her bed in hospital.

The block diagram of a Healthcare monitoring system is as shown in followingfigure 1.The system is consists of the advance embedded ARM-7 controller to which we have connected the Temperature sensor, HB sensor, Blood pressure sensor, siren and emergency button also. All collected data are transfer to the PC. Then all data are received by PC thatwill automatically it display.

Components used in the system are as follows: ARM-7

ARM is a family of instruction set architectures for computer processors based on aeduced instruction set computing (RISC) architecture developed by British company ARM Holdings. A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical processors in average computers. This approach reduces costs, heat and power use. These are desirable traits for light, portable, battery powered devices including smartphones, laptops, tablet and notepad computers, and other embedded systems. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing higher processing power and improved energy efficiency for servers and supercomputers.LPC2148 is the widely used IC from priorities and vector addresses.

• Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package. • Up to nine edge or level sensitive external interrupt pins available.

• On-chip integrated oscillator operates with an external crystal in range from 1 MHz to30MHz and with an external oscillator up to 50 MHz.

• Power saving modes include Idle and Power-down.

• Individual enable/disable of peripheral functions as well as peripheral clock scaling for additional power optimization.

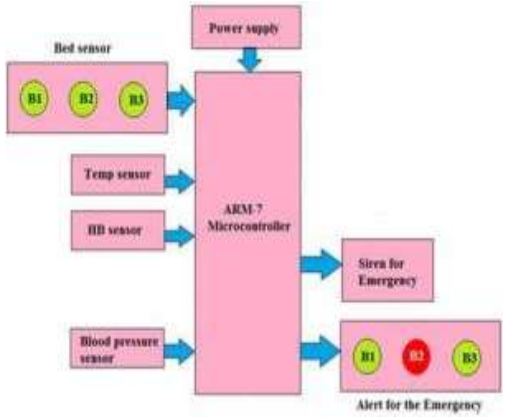

Fig. 2 Block Diagram of the Healthcare Monitoring system

• Processor wake-up from Power-down mode via external interrupt, USB, Brown-Out Detect (BOD) or Real-Time Clock (RTC).

• Single power supply chip with Power-On Reset (POR) and BOD circuits:

– CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/Opads.

• 32Khz crystal for RTC

Fig. 3 Board of LPC2148

The LPC2148 microcontroller has 512KB of internal flash and 32+8K RAM, can beclocked up to 60Mhz. LPC2148 features include USB 2.0 device, 2xUARTs, RTC, 2x10bitADCs each ADC has multiple channels,

1xDAC, 6XPWM, 2xI2C, 1xSPI, 1XSSP, 2x32-bit TIMERS, FAST I/0 support and WDT. LPC2148 also supports In System Programming (ISP).

Following are the salient features of the board:

• Dimensions: 47x47 mm2

• Two layer PCB (FR-4 material

• 12MHz crystal

line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply. Each DS18B20 has a unique 64-bit serial code, which allows

multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can

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benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

Applications

- Thermostatic Controls
- Industrial Systems
- Consumer Products
- Thermometers
- Thermally Sensitive Systems

BENEFITS AND FEATURES

- Unique 1-Wire® Interface Requires Only One Port Pin for Communication
- Reduce Component Count with Integrated Temperature Sensor and EEPROM
- Measures Temperatures from -55°C to +125°C (-67°F to +257°F)
- ±0.5°C Accuracy from -10°C to +85°C
- Programmable Resolution from 9 Bits to 12 Bits
- No External Components Required
- Parasitic Power Mode Requires Only 2 Pins for Operation (DQ and GND)
- Simplifies Distributed Temperature-Sensing Applications with Multidrop Capability

Fig. 4 PIN Diagram of LPC214X

TEMPERATURE SENSOR DS18B20

The DS18B20 digital thermometer provides 9-bit to 12- bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a
1-Wire bus that by definitionrequires only one data

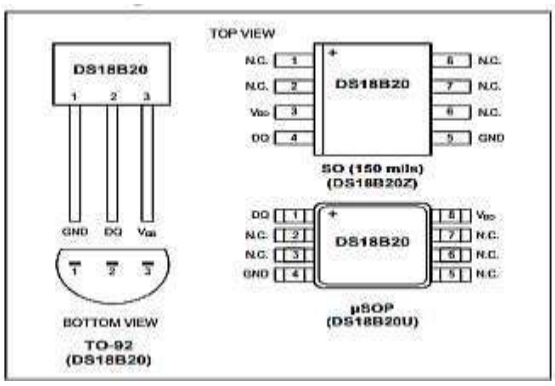

Fig. 5 Pin Configurations of DS18B20

Fig. 6 Heart Beat Sensor

- Each Device Has a Unique 64-Bit Serial Code Stored in On-Board ROM
- Flexible User-Definable Nonvolatile (NV) Alarm Settings with Alarm Search
  Command Identifies Devices with Temperatures outside Programmed Limits
- Available in 8-Pin SO (150 mils), 8-Pin μSOP, and 3- Pin TO-92 Packages

HEART BEAT SENSOR

Use of Heartbeat sensor to measure the Heart Rate or pulse rate of a person. HeartBeat sensor measures the heart rate through the fingertip. This Heart Beat Sensor provides an easy way to integrate heart rate measurement into project. When the heart beats it pumps
blood into your artery of your finger tip. This causes a change in the blood volume which isthen sensed by our HeartBeat sensor. The sensor used infrared light source on one side of finger and a photo detector on another side to measure this change in the blood flowing.

A person's heartbeat is the sound of the valves in his/her's heart contracting orexpanding as they force blood from one region to another. The number of times the heartbeats per minute (BPM), is the heart beat rate vascular region). In case of applicationswhere heart pulse rate is to be monitored, the timing of the pulses is more important. Theflow of blood volume is decided by the rate of heart pulses and since light is

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absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

- There are two types of photophlethysmography:

1. Transmission: Light emitted from the light emitting device is transmitted through any vascular region of the body like earlobe and received by the detector.
2. Reflection: Light emitted from the light emitting device is reflected by the regions.

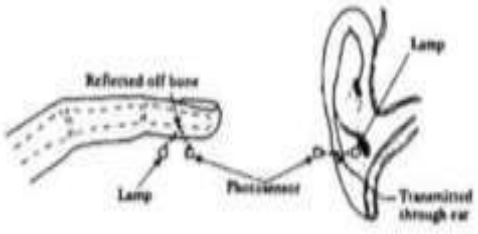

Fig. 7 Transmission and Reflection of Photophlethysmography

Working of a Heartbeat Sensor

The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. The heart beat pulses causes a variation in the flow of blood to different regions of the body. When a tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The and the beat of the heart that can be felt in any artery that lies close to the skin is the pulse.

- **Manual Way**: Heart beat can be checked manually by checking one's pulses at two locations- wrist (the radial pulse) and the neck (carotid pulse). The procedure is to place the two fingers (index and middle finger) on the wrist (or neck below the windpipe) and count the number of pulses for 30 seconds and then multiplying that number by 2 to get the heart beat rate. However pressure should be applied minimum and also fingers should be moved up and down till the pulse is felt.

- **Using a Sensor**: Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heart beat changes.

Principle of Heartbeat Sensor

The heartbeat sensor is based on the principle of photo phlethysmography. Itmeasures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a amount of light absorbed depends on the blood volume in that tissue. The detector output is in form of electrical signal and is proportional to the heart beat rate.

This signal is actually a DC signal relating to the tissues and the blood volume and the AC component synchronous with the heart beat and caused by pulsate changes in arterial blood volume is superimposed on the DC signal. Thus the major requirement is to isolate that AC component as it is of prime importance.

To achieve the task of getting the AC signal, the output from the detector is firstfiltered using a 2 stage HP-LP circuit and is then converted to digital pulses using a comparator circuit or using simple ADC. The digital pulses are given to a microcontroller for calculating the heat beat rate, given by the formula-

BPM(Beats per minute) = 60*f

Where f is the pulse frequency

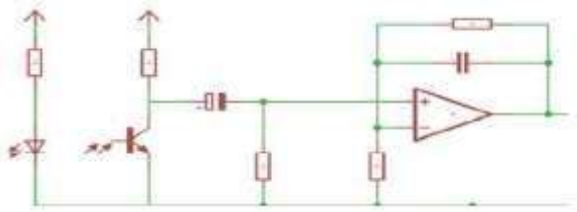

Fig. 8 Circuit Diagram of Heartbeat Sensor

DESIGN OF INDIVIDUAL MODULE

Power Supply

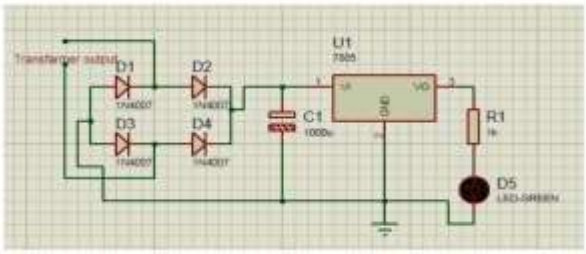

Fig. 9 Circuit Diagram of Power Supply

Power is derived initially from standard 12V AC/DC adapter or 12V_500ma Transformer. This is fed to bridge rectifier D1 ~ D4, the output of which is then filtered using 1000uf electrolytic capacitor and fed to U2 (voltage regulator). U2 +5V output powers the PIC micro controller. LED L10 and its associate 1K current limiting resistors provide power indication. The unregulated voltage of approximately 12 V is required for relay driving circuit.

Micro controller required 5V DC supply for operation, we used USB +5V Power from PC or External +5V power supply via CN10. External Power and USB power can be selectable via J1. There is need 12V external

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PRACTICAL HEARTBEAT SENSOR

Practical heartbeat Sensor examples are Heart Rate Sensor (Product No PC-3147). It consists of an infrared led and an ldr embedded onto a clip like structure. The clip is attached to the organ (earlobe or the finger) with the detector part on the flesh.

require step down transformer. Following are the main characteristic of electronic transformer.

1) Power transformers are usually designed to operate from source of low impedance at a single freq.

2) It is required to construct with sufficient insulation of necessary dielectric strength.

3) Transformer ratings are expressed in volt–amp. The volt-amp of each secondary winding or windings is added for the total secondary VA. To this are added the load losses.

4) Temperature rise of a transformer is decided on two well-known factors i.e. losses on transformer and heat dissipating or cooling facility provided unit.

RECTIFIER UNIT

Rectifier unit is a circuit which converts A.C. into pulsating D.C. Generally semiconducting diode is used as rectifying element due to its property of conducting current in one direction only. Generally there are two types of rectifier.

1) Half wave rectifier

2) Full wave rectifier

In half wave rectifier only half cycle of mains A.C. is rectified so its efficiency is very poor. So we use full wave bridge type rectifier, in which four diodes are used. In each half cycle, two diodes conduct at a time and we get maximum efficiency at o/p. Following are the main advantages and disadvantages of a full-wave bridge type rectifier circuit.

Advantages:

1) The need of center tapped transformer is eliminated.

2) The o/p is twice that of center tap circuit for the same secondary voltage.

3) The PIV rating of diode is half of the center-tap Power supply for relay's and its driver circuits.

POWER SUPPLY DESIGN

Power supply is the most important part of the project. For project +5V regulated power supply with maximum current rating 500mA. Following basic building blocks are required to generate regulated power supply.

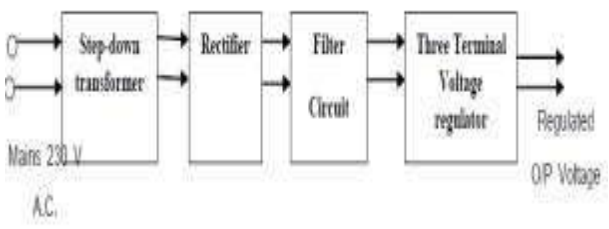

Fig. 10 Block Diagram of Power Supply

STEP DOWN TRANSFORMER

Step down transformer is the first part of regulated power supply. To step down the mains 230V A.C. we

A voltage regulator is a circuit that supplies constant voltage regardless of change in load current. IC voltage regulators are versatile and relatively cheaper. The 7800 series consists of three terminal positive voltage regulators. These ICs are designed as fixed voltage regulator and with adequate heat sink, can deliver o/p current in excess of 1A. These devices do not require external component. This IC also has internal thermal overload protection and internal short circuit and current limiting protection. For our project we use 7805 voltage regulator IC.

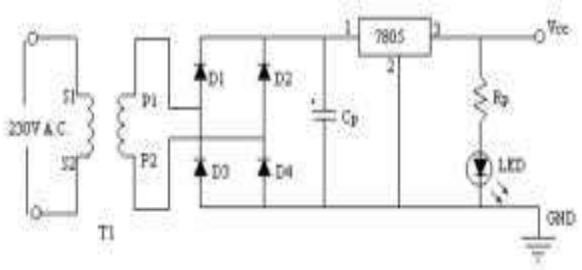

Fig. 11 Regulated Power Supply

SELECTION OF COMPONENTS FOR POWER SUPPLY

Design of components for power supply are given below, Design of Step Down Transformer

The following information must be available to the designer before he commences for the design of transformer.

1) Power Output.

2) Operating Voltage.

3) Frequency Range.

4) Efficiency and Regulation.

Size of core

Size of core is one of the first considerations in regard of weight and volume of transformer. This depends on type of core and winding configuration used. Generally following formula is used to find area or size of core.

circuit.

Disadvantages:

1) It requires four diodes.

2) As during each half cycle of A.C. input, two diodes are conducting therefore voltage drop in internal resistance of rectifying unit will be twice as compared to center tap circuit.

FILTER CIRCUIT

Generally a rectifier is required to produce pure D.C. supply for using at various places in the electronic circuit. However, the o/p of rectifier has pulsating character i.e. if such a D.C. is applied to electronic circuit it will produce a

hum i.e. it will contain A.C. and D.C. components. The A.C. components are undesirable and must be kept away from the load. To do so a filter circuit is used which removes (or filters out) the A.C. components reaching the load. Obviously a filter circuit is installed between rectifier and voltage regulator. In our project we use capacitor filter because of its low cost, small size and little weight and good characteristic. Capacitors are connected in parallel to the rectifier o/p because it passes A.C. but does not pass D.C. at all.

THREE TERMINAL VOLTAGE REGULATORS

Turns per volt of transformer are given by relation

Turns / Volt = 10000/4.44 f Bm Ai Here, F is the frequency in Hz Bm is flux density in Wb/m2 Ai is net area of cross section.

Following table gives the value of turns per volt for 50 Hz frequency.

Table 1 Value of Turns Per Volt for 50 Hz Frequency

Flux density Wb/m2	1.14	1.01	0.91	0.83	0.76
Turns per volt	40/Ai	45/Ai	50/Ai	55/Ai	60/Ai

Generally lower the flux density better be quality of transformer. For project for 50 Hz the turns per Volt for 0.91 Wb/m2 from above table. Turns per Volt = 50 / Ai

=50/2.88

≅ 17

Thus for Primary winding = 220 x 17 = 3800.

& for Secondary winding = 12 x 17= 204. Wire size

As stated above size depends upon the current to be carried out by the winding, which depends upon current density of 3.1 A/mm2. For less copper losses 1.6 A/mm2 or 2.4 A/mm2 may be used. Generally even size gauge of wire are used.

Rectifier Design

Ai =√P1/0.87

Ai = Area of cross - section in Sq. cm. and

P1= Primary voltage.

In transformer P1 = P2

The project requires +5V regulated output. So transformer secondary rating is 12V, 500mA.

So secondary power wattage is, P2 = 12 x 500 x 10^{-3}w.

= 6w

So Ai = √6/0.87

= 2.62

Generally 10% of area should be added to core to accommodate all turns for low Iron losses and compact size.

So, Ai = 2.88. Turns per volt

choose 1000 μf / 25V filter capacitor. IC7805 (Voltage Regulator IC) Specifications:

Available o/p D.C. Voltage = + 5V. Line Regulation = 0.03

Load Regulation = 0.5

Vin maximum = 35 V

Ripple Rejection= 66-80 (dB)

Selection for Current Limiting Resistance for LED Fig.3.12 Current Limiting Resistance

The output of microcontroller is equal to supply voltage i.e. +5V DC. If directly connected LED to micro controller then very high current flowing through it because internal resistance of LED is very small about 5 to 8 ohm so it is possibility to damage LED so we place current limiting resistance R in series with diode the value of this resistance is calculated.

From ohms low

V = R I Where

I= If safe forward current flowing through LED which normal intensity glow and this value near about 8 to 10 mA

5 = Rx 8mA

R = 625 Ω

So we select near about value 680Ω.

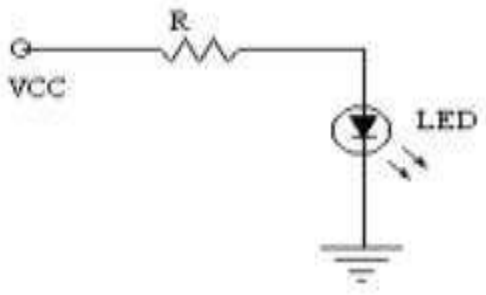

Fig. 12 Current Limiting Resistance

R.M.S. Secondary voltage at secondary of transformer is 12V.

So maximum voltage Vm across Secondary is

= Rms. Voltage x □2

= 12 x □2

= 16.97

D.C. O/p Voltage at rectifier O/p is 2 Vm

Vdc = 2Vm/ □□

= 2 x 16.97/ □□

= 10.80 V

PIV rating of each diode is, PIV = 2 Vm.

= 2 x 16.97

= 34 V

Maximum forward current which flow from each diode is 500mA. So from above parameter. we select diode IN 4007 from diode selection manual. Design of Filter Capacitor

Formula for calculating filter capacitor is,

C= 1/4□3 r f RL.
r = ripple present at o/p of rectifier. (This is maximum 0.1 for full wave rectifier.)
F = frequency of mains A.C.
RL = I/p impedance of voltage regulator IC. C=1/4□3 x 0.1 x 50 x 28
= 1030 □f
□□1000 □f
Voltage rating of filter capacitor is double of Vdc i.e. rectifier o/p which is 20V. So we

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