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A Secure Remote Patient Communication System Using Iot

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Abstract: *The Internet Of Things (Iot) Is Vastly Used In Different Technologies Across Various Fields. It Has Also Been Used In Healthcare Sectors. Today, Reshaping Modern Health Care Systems Is Possible Through Iot As It Provides Economical, Technological And Social Prospects. This Project Describes About Building A Wireless Healthcare Monitoring System Using Iot Module. Remote Health Monitoring Is Considered As An Effective Method Of Providing Immediate Medical Care. It Facilitates Continuous And Timely Transmissions Of Patient Health Data To Doctors Or Healthcare Providers. In This Research, Remote Patient Monitoring Will Enable Professional Medical Care To Patients And Also Redefine Work, Home And Recreational Activities. These Newly Designed Technologies Make It Possible For Us To Perform Monitoring Of Patients On A Regular And Timely Basis. This Replaces The Need For Recurrent Hospital Visits In Cases Of Chronic Illnesses. Recent Studies Have Shown That Terminal Illnesses Have Resulted To Major Death Cause In India. Patients Suffering From Chronic Diseases Need To Continuous Monitoring. Monitoring Of Vital Signs Include Four Parameters: Temperature, Blood Pressure, Pulse Rate And Blood Oxygen Saturation. These Parameters Provide Data Regarding Patient's Health Status And Can Identify Any Existing Medical Conditions In Person's Body.*

Keywords:*Internet Of Things (Iot), Remote Patient Monitoring, Temperature, Pressure.*

1. INTRODUCTION

The Internet Of Things (Iot) Has Successfully Made It Possible To Connect Electronically Embedded Devices. These Devices, With The Help Of Network Connectivity Are Used As Software Sensors. Gathering And Exchanging Information In These Devices Is Made Possible By Iot. [1]. Iot Comprises Of Diverse Layers Right From The Perception Of Network Till The Application Layers. [2]. Iot In The Medical Field Known As Telemedicine Provides Medical Care By Providing Data Communications And Interactive Audio And Visual Features [3]. Even Today, The Most Used Method Of Monitoring Vital Signs Is The Manual Method, In Which The Nurse Checks The Vital Signs Either In A Clinical Setting Or At Homes. This Manual Method Is Considered Conventional And Most Reliable. The Elderly

Population Is Known To Suffer From Several Chronic Illnesses. Due To Many Factors Such As Financial Constraints, Lack Of Transportation Or Caregiver, It Is Not Possible To Make Regular Hospital Visits. It's Also Seen That In A Hospital The Nurse To Patient Ratio Is Comparatively Low. Such Situations May Sometimes Lead To Non-Assessment And Recording Of Vital Signs. Lack Of Timely Monitoring Of Vital Signs May Cause Problems To The Patients. Assessment Of The Vital Signs Value Also Requires The Consultation Of A Doctor Or A Nurse, Which Is Again Cost Bound. Advancement In Technology, Especially In The Field Of Sensor And Connectivity Is Of Great Help In Such A Medical Based Scenario By Collecting, Recording And Analyzing Data. Patients' Data Can Be Collected Over A Long Term, Which In Turn Can Be Used For Preventive Care For Early Diagnosis Of Diseases. Iot In Health Care Systems Are Based Mainly On The Device's Network Which Enables Them To Directly Connect With Each Other For Capturing And Sharing Important Data Through A Wireless Medium And Can Be Stored In A Server. It Also Enables Users To Have Access To The Information Through Mobile Phones Connected Via Bluetooth. Iot Systems Have Enhanced Health Care By Providing Quality Of Care With Reduction In Cost Rates. In The Past Years, Several E- Health Care Systems Have Been Developed, Which Provide Provisions For Remote Monitoring Of Patients' Health. With Accordance To The Recent Social Insurance Framework, Patients Reside At Their Homes During Their Post Operation Days. Assessment Of These Patients Is Done By An Overseer Or By A Medical Caretaker. However, Constant And Continuous Observation May Not Be Successfully Guaranteed. Absence Of The Attendant Or The Caretaker Even For Seconds May Cause Changes In Parameters Thus Causing Note Worthy Harm To The Patient. Hence, This Innovation Of Iot For Health Care Enables And Promotes Heath Awareness Framework In Which Timely Assessment Of Patients' Health Is Accomplished. The Block Diagram Of The Health Monitoring System Is Illustrated In Figure 1.
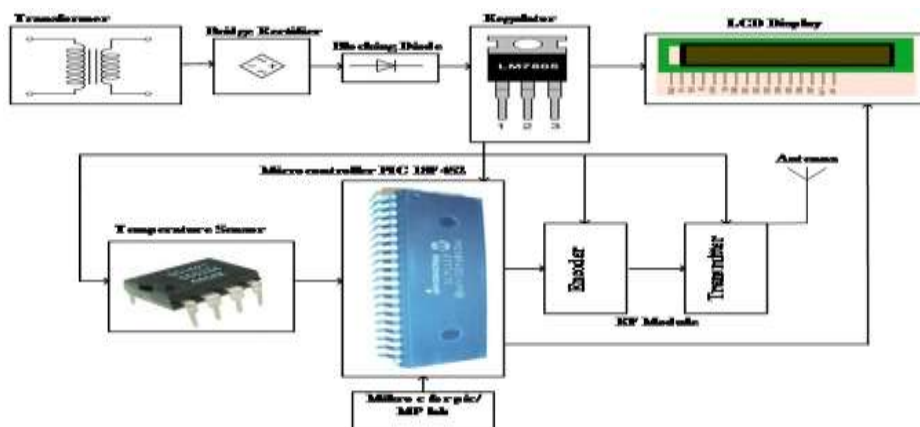

Fig. 1.Health Monitoring System.

2. RELATED WORKS

S. J. Jung And W. Y. Chung Studied The Flexible And Scalable Patient's Health Monitoring System In 6lowpan[4] . Communication Solutions And A Combination Of Technologies Are The Prime Advantages Of The Enabling Factor. A Collaboration Of Activities Combined In The Various Fields Of Knowledge Such As Informatics, Electronics And Telecommunications Are A Result Of Iot. K. S. Shin And M. J. Mao Kaiver Researched Health Monitoring System Based On Cell Phone, Incorporating Iot And Self-Analysis [5] This New Model Uses Devices That Are Capable Enough To Collect Data From Surroundings And Also Interrelate

With The World. Through Internet These Are Interconnected With Each Other And Consequently Exchange Data And Information. Gennaro Tartarisco And Tabilo Paniclo[6] Have Conducted A Study To Form A Modern Technology On Wireless Communication, Clinical Decision Making And Processing Of Information. This Study Was Carried Out In Large Sensor Networks. Data Mining Was Also Used In The Branch Of Health Care. Research Work By Cristina Elena Turcua[7] On Health Care Applications Presents Comprehensive And Complete Data Regarding Development And Improvement In Peoples Accessibility Towards Heath Care Systems And Processes Using Internet Of Things Iot And Radio Frequent Identification.

Gubbi, Jayavardhana, Buyya, Rajkumar, Marusic, Slaven, Palaniswami, Marimuthstudied The Internet Of Things (Iot): A Vision, Architectural Elements, And Future Direction Which Proposes On Demand Positioning And Tracking System [8]. This Concept Is Built On Devices Facilitated With Global Positioning And Is Appropriate In Larger Domains. Initial Communication Is Developed Using The Terminals Of Two Smart Phones. This Initial Communication Is Achieved By Synchronization Phase. Yoon Et Al. [8] Developed And Demonstrated Piezoelectric Sensor. This Device Has Can Be Attached To The Skin And Can Be Used To Sense The Human Arterial Pulse And Hr Estimation. The Sensor Was Fixed On A Polyimide Substrate With The Help Of A Small Slit. A Polyvinylidene Fluoride-Tri Fluoroethylene (P(Vdf-Trfe)) Was Spin Coated With Silver Electrode Piezoelectric Layer Which Was Thermally Evaporated. Any Changes In The Pressure Of The Radial Artery Creates Variations On The Piezoelectric Layer, Which Is Transmitted To The Electrodes Causing Potential Variation. Tajitsu Et Al. [9] Brought About A Variation By Using A Wristband By Placing Piezoresistive Pressure Sensor For Monitoring Heart Rate. This Piezoresistive Material Was Made Using Electro-Spinning. Nonwoven Acrylate Was Formed To Polytetrafluoroethylene (Ptfe) Fabric. Aluminum Electrode And Ptfe Were Coated On A Polyethyleneterephthalate (Pet) Film. Result Of This Wrist Band Was That Its Pulse Wave Measurement Was Identical To The Patterns Formed By Ecg Signal. The Added Advantage Of The Band Was High Accuracy And Lower Susceptibility To Motion Induced Noise. A Few Researches Have Combined Digital And Analog Signal Processing Units By Using System-On-Chip (Soc) Technologies.

Izumi Et Al. [10] Designed A Near Field Communication (Nfc) Module In The Form Of A Wearable Device. It Consisted Of An Ecg Processing Chip And A Three- Axis Accelerometer. This Device Was Developed To Carry Out Communication Via A Smart Phone And Functions Such As Data Collection, Processing Ecg And Accelerometer Signals. Short-Term Auto Correlation (Stac) Between A Template And Measured Signal Was Used As A Measure To Identify The R- Peak And Estimate The Hr Basic 130-Nm Cmos Technology Was Used To Fabricate The Chip. Performance Of This System Was Monitoring For Approximately 24 Days Consuming 35 Mah Battery And ~13.7 µa Current. A Relatively Low-Power Asic Was Established To Monitor Cardio- Vascular Functions. [11], This Was Designed Using 0.18 µm Cmos Technology And Two-Stage Miller-Compensated Programmable Gain Amplifier (Pga), Qrs And Baseline Amplifiers, Dc Voltage Generator And A Comparator. The Advantages Of This Device Were Providing Self-Biasing Capability, And Lesser Voltage Requirement. Functions Of 'Qrs Amp' And A 'Baseline Amp' Was To Form A Baseline Drift By Filtering The Signal And Isolating The Qrs Symbols. Detection Of R- Peaks Was Done Comparing The Shifted Baseline And Qrs Complex Signal By Adding A Dc Voltage. The Capacity Of This System Was Minimum Requirement Of 58 Nw Of Power And Can Be Used For One Year With A 0.7 Mah Thin-Film Battery, This Property Makes It Appropriate For Applications That Intend To Function For Long Term. Helleputte Et Al. [12] Brought Out A Design Of A 3-Channel Bio-Potential Acquisition Integrated Circuit. Every Channel Was Equipped In Measuring Ecg And Electrode-Tissue Impedance (Eti). This Is Considered

Corresponding To The Motion Artifacts. Adaptive Lms Filters Are Used To Estimate Motion Artifacts In Real-Time. These Are Then Removed Before Amplifying The Rcg Signals.

3. PROPOSED SYSTEM

In The Past Decades, The Condition Of Health Care System Has Been Such That The Availability Of Doctors Was Very Much Inadequate As Compared To Number Of Patients Needing Medical Attention[13]. The Size Of Medical Instruments And Devices In Special Care Units Set Up Like Icus Were Also Big Which Made It Necessary For A Nurse Or A Doctor To Personally Attend Patients..
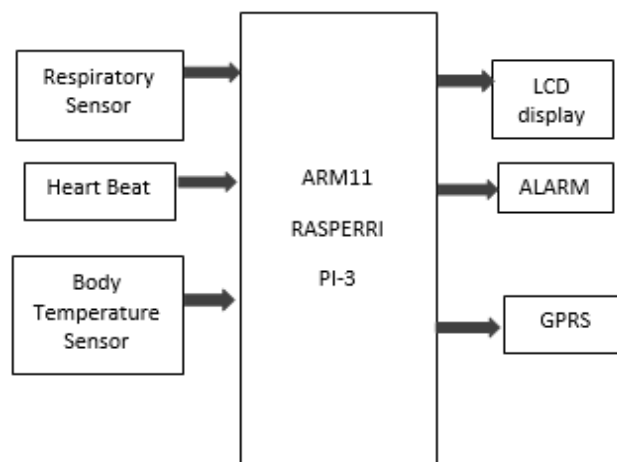

Fig. 2.Block Diagram

Hence The Other Patients Could Not Be Monitored On A Continuous Basis. These Factors Led To The Following Issues: Finding The Patients And Providing The Appropriate Medical Care. Assessment Of Each Patient Took A Considerable Amount Of Time[14]. Human/ Manual Attention Was Not Possible For Each Patient. Lack Of Medical Instruments. Most Patients Could Not Be Provided With The Emergency Care And Died Due To Lack Of Essential Machinery And Experts. The Aim Of This Study Is Assessing The Needs Of Medical Doctors With Respect To Wireless Patient Monitoring System. The System Uses Graphical Programming Environment For Processing Data With The Help Of Plug-In Analysis Components Which Can Be Formed Into Plans. The Block Diagram Of The Proposed System Is Depicted In Figure 2.

A Transformer Is A Passive Electrical Apparatus That Transfers Energy By Inductive Coupling Between Its Winding Circuits. It Functions By Creating Variation Of Current In The Primary Winding Which In Turn Creates Varying Magnetic Flux In The Transformer's Core And Thus A Varying Magnetic Flux In The Secondary Winding. Each Device Is Able To Provide A Constant Dc Voltage Within Its Fixed Power Supply Limit. A Rectifier Generates Direct Current (Dc), By Periodically Reversing The Direction Of Current In One Direction. A Capacitor Filter Is Another Device Used In Places With Lower Power Supply. This Frequency Is Comparatively Higher. A Temperature Sensor Is Used To Measure Temperature. Lm35 Is A Standard Sensor That Can Be Used For This Experimental Purpose. It Provides Readings In Both Centigrade (Degree Celsius) And Fahrenheit. Heart Rate Is An Essential Parameter That Determines The Wellness Of Cardiovascular System. With Every Heartbeat, The Heart Pumps Blood Throughout The Body That Causes Variations In The Blood Volume Of Finger Arteries. This Variation In The Blood Volume Generates Pulsations That Can Be

Detected Through An Optical Sensing Mechanism Placed Around The Fingertip. The Mechanism Is Depicted In Figure 3.
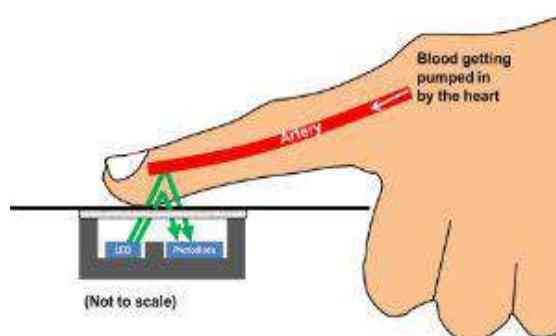

Fig. 3.Mechanism Of Heart Rate Sensor

16 * 2 Lcd Will Be Used Which Is Capable Of Displaying 16 Characters Per Line. There Are 2 Such Lines Which Are Connected To A Microcontroller. Output Is Shown Through All Sensors. A Specialized Modem Known As Iot Modem Uses Sim Card Subscription Like A Mobile Phone. This Looks Similar To A Mobile Phone. Connecting An Iot Modem To A Computer Enables It To Use The Iot Modem For Communication These Are Usually Used For Internet Connectivity, And For Sending And Receiving Sms And Mms Messages. An Iot Modem Can Either Be Used As A Mobile Phone That Provides Iot Modem Capabilities Or As A Dedicated Modem Having A Serial, Usb Or Bluetooth Connection. In The Field Of Health Management System, Which Is Designed For Integrated Patient Monitoring, This Technology Is Mainly Used For Continuous Monitoring Devices With Lower Cost. Hence This Proves To Be An Effective And Accurate Way For Measuring Patient's Physiological Parameters Such As Temperature, And Pulse Rate. There Has Been A Significant Rise In The Use Of Wearable Sensors In The Past Recent Years And Today Numerous Such Devices Are Made Commercially Available For Fitness, Personal Health Care, And Activity Output Parameters. The Ifttt Is Programmed Such That If The Sensor Output Values Exceed The Given Range Then An Alert Is Sent To Pre-Assigned Email Awareness. Iot Based Health Care Application Enables Capturing And Sharing Vital Data. It's A Combination Of Sensors And Microcontrollers Where Data Is Further Analyzed. Techniques Like Data Mining Are Applied For Assessment Of Findings Or Values Of Vital Signs Data By Use Of Classification Model. This Will Determine The Healthy Or Unhealthy Vital Signs Even Without The Presence Of A Nurse Or A Health Care Professional. For Monitoring Of Chronic Diseases, Vital Signs Are Captured With The Help Of Medical Sensors. Data Is Analyzed Using Data Mining Algorithms. Doctors Can Easily Access The Data Wirelessly And Determine Diagnosis And Treatment Plans. A Considerably Huge Amount Of Data Is Generated By These Applications. Using This Model, The Patients Will Be Automatically Made Aware Of Healthy Or Unhealthy Vital Signs. The Flowchart Of The Proposed System Is Given In Figure 3.
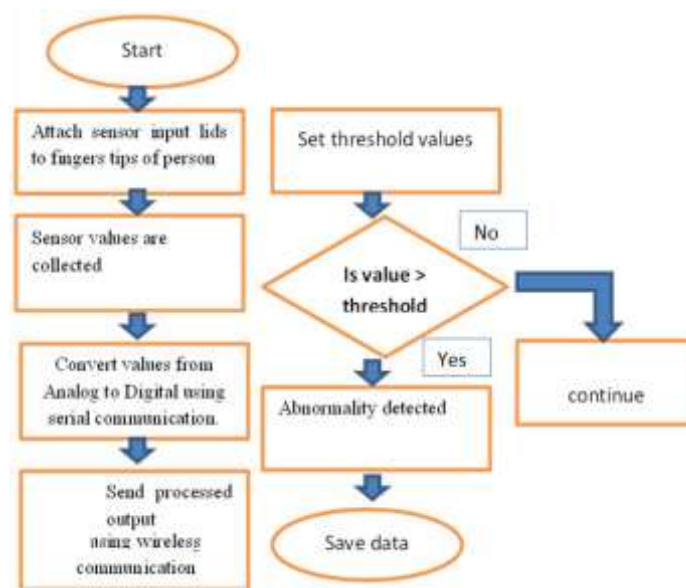
Fig. 4.Flowchart Of The Proposed System

4. IMPLEMENTATION

Pulse Sensor Is Connected To Fingertip Or Ear Lobe As Pulse Can Be Detected Easily From There. The Pulse Sensor Emits And Detects The Light Rays Into The Ear Or Finger And Calculates The Pulse Rate. The Output Analog Pulse Rate Is Attached To The A0 Analog Input Pin Of The Node Mcu. The Input Connected To The Node Mcu Is Converted Into Digital Form. The Temperature Sensor Is Placed To The Patient's Body Which Determines The Temperature And Converts It Into Digital Form. The Sensor Is Attached To The D3the Digital Input Pin Of The Node Mcu. Vibration Sensor Has Two Separated Contacts If Patient's Body Vibrates Then Sensor Short Circuits And Gives Digital High Output. If Not Remains As Low Output. The Vibration Sensor Output Is Connected To The D5 Pin Of Node Mcu. Node Mcu Connected To Internet With Built In Wifi Module Updates The Sensor Output Values To The Thingspeak Server. Ifttt Cloud-Based Service Is Assigned With Particular Range Of Sensor. Figure 4 And Figure 5 Shows The Implementation Results Of The Proposed System.
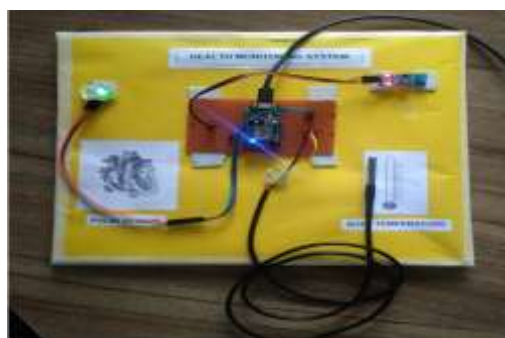

Fig. 5.Experimental Setup

Fig. 6.Thing Speak Iotresults Of The Proposed System

5. CONCLUSION

Continuous Monitoring Of Our Family Members Is Not An Easy Piece Of Work In Today's Life. It Is Also Difficult To Keep A Track On Patient's Health At Home. Old Aged Patients Need Special Attention Through Periodic And Timely Monitoring And Their Relatives Must Be Informed Regarding Their Health Status While They Are At Work. So, A System With An Innovative Idea Is Required To Put These Considerations At Ease. The Proposed System In This Study Uses Temperature And Heartbeat Sensors To Keep An Eye On Patient. These Sensors Are Connected To An Mcu Which Is Associated To A Wifi Module Connection To Transfer Alerts. If Any Abnormality Or Abrupt Changes Are Identified By The Sensor In The Patient's Temperature Or Heartbeat, The User Is Automatically Alerted Regarding The Status Of The Patient. It Also Shows Details Of These Abnormalities Of Patient Live Over The Internet. The Transfer Of Data From Sensors To Cloud (Thing Speak) With The Help Of Iot Is Experimentally Tested. This Data Is Considered To Be Very Useful For Future Analysis And It Can Also Be Shared To Other End Users. Through Wi-Fi, The Data Accumulated And Analyzed Results Will Be Sent To End User. Thus, Patient Health Monitoring System Built On Iot Is Successfully Helpful In Monitoring Patient Health Status.

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