An Intelligent Method for Predictive Monitoring of Patient Health Parameters using Data Mining Techniques

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Abstract—Presently a day Internet of Things is all of a sudden expanding innovation. IOT is the system of physical protest or things implanted with programming sensors, gadgets and system availability. IOT is utilized to gather data and trade information. In this paper, we are building up a framework which will consequently screen the mechanical applications. IOT has given a capable method to assemble mechanical framework by utilizing remote gadgets, and sensors. IOT idea is to screen and control the business. In stage I the hard product was planned effectively utilizing IOT. The contribution from sensor and information yield can be shown in the LCD (16*2).microcontroller (PIC16F887) which is utilized to gather information from sensors and showed in LCD. The showed information can be seen by server utilizing IOT. The exhibitions are confirmed tentatively utilizing IOT. In Phase II the information from the server can be screen through PC .The mechanical information can be seen through URL.

*Keywords-*Internet of Things, industrial applications, microcontroller, health care parameters, personal computer.

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I. INTRODUCTION

The Internet of things (IoT) is the system of physical gadgets, vehicles and other implanted with hardware, programming, sensors, actuators and system network which empower these articles to gather and trade information. Every thing is particularly identifiable through its installed figuring framework however can interoperate inside the current Internet foundation. Specialists gauge that the IoT will comprise of around 30 billion questions by 2020.The IoT enables articles to be detected or controlled remotely crosswise over existing system framework, making open doors for more straightforward incorporation of the physical world into PC based frameworks, and bringing about enhanced effectiveness, exactness and financial advantage notwithstanding decreased human intercession. At the point when IoT is enlarged with sensors and actuators, the innovation turns into an example of the more broad class of digital physical frameworks, which additionally envelops advancements, for example, keen lattices, virtual power plants, brilliant homes, clever transportation and savvy urban areas.

II. LITERATRURE SURVEY

Aieshwarya.B.ChavanPatil [1] presents a health monitoring system that uses the sensors for collecting data from patients, intelligently predicts patient's health status and provides feed-back to doctors through their mobile devices having android applications. The patients will participate in the health care process by their mobile devices and thus can access their health information from anywhere any time.Bourouis [3] has discussed about ubiquitous healthcare system. It is an emerging technology that provides easy healthcare service to patients, and convenient to diagnose patient's health condition. It provides increase in accuracy, efficiency and availability of medical treatment so people can monitor their health by an online medium without visiting the hospital or clinic.Yuce[9] has discussed about Healthcare monitoring system where the patient carries a set of WBAN devices and the patient is ambulatory, but is always on the reach of the gateway that binds the sensors with the medical central unit. These devices communicate remotely through the internet with a monitoring medical central unit installed in a hospital or clinic responsible for monitoring patient's health status. [7, 8].Caregivers can connect through the internet via computers or mobile devices to the medical central unit to supervise patient's data processed and analyzed by dedicated applications. The object is to address the data privacy of the mobile WBAN sensors exchanged with the remote medical central unit. Kumar [6] has discussed about security for healthcare techniques. Introducing new technologies in healthcare system without considering security makes patient privacy vulnerable. The physiological data or report of an each and every individual patient is highly sensitive. The wireless medical sensors produce or collected large data which must be secured from security attacks. The success of healthcare applications mainly depends on patient security and privacy.P.Deepika [5] has provided different types of classification techniques in the field of Heart Disease prediction that include mainly five

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different classification algorithms namely Classification by decision tree, Bayesian Classification, Neural Networks, Support vector machine, Classification based on association are out of which Neural networks give 100% accuracy while decision trees and naive bays provide 99.62% and 90.74% accuracy according to K.Thenmozhi [8].

III. PROPOSED SYSTEM

In the broadest definition, a sensor is an electronic component, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as a computer.Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micro machinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure or flow measurement, for example into MARG sensors.

Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine, robotics and many other aspects of our day-to-day life.A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C (it is basically the slope Dy/Dx assuming a linear characteristic). Some sensors can also affect what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors are usually designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as micro sensors using MEMS technology. In most cases, a micro sensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches.

LM35 Temperature Sensor Introduction and Fundamentals

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user convenient Centigrade scaling. The LM35 does not require any external is not required to subtract a large constant voltage from its output to obtain calibration or trimming to provide typical accuracies of ±¼°C at room
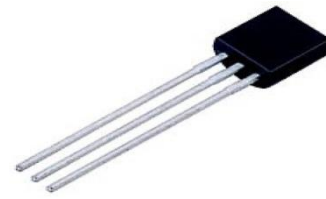

Fig 1: LM35 Temperature sensor

The LM 35 IC generates a 10mV variation to its output voltage for every degree Celsius change in temperature. The Output of the temperature sensor is analog in nature so we need an analog to digital converter for converting the analog input to its equivalent binary output. The ADC 0804 is the analog to digital converter IC used in the project. 0804 is a single channel converter which converts the analog input up to a range of 5V to an equivalent 8-bit binary output.

PRESSURE SENSOR

Weight sensors screen a patient's condition by giving exact and dependable diagnostics in a wide scope of conditions. These gadgets are particularly intended for applications where high caliber and unwavering quality are particularly vital and are built utilizing materials with a demonstrated history in the social insurance industry. Weight sensors depend on piezoresistive innovation and offer an extensive variety of capacities and highlights—from fundamental, to completely open up and temperature repaid gadgets. The completely increased arrangement can be effectively associated with a MCU. There are likewise computerized weight sensors that give extra adaptability by wiping out the requirement for a different ADC part. These weight sensors convey on both I2 C and serial fringe interface SPI transports, giving an immediate association with the principle framework processor for correspondence effortlessness and adaptability.

DRIP LEVEL SENSOR

The Drip Detect sensor is designed to be utilized as a technique for monitoring media flow rate during patient IV infusion.

Fig 2: Drip level sensor

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HEARTBEAT SENSOR

Heart beat sensor is intended to give computerized yield of warmth beat when a finger is set on it. At the point when the heart beat identifier is working, the beat LED flashes as one with every pulse. This computerized yield can be associated with microcontroller specifically to gauge the Beats every Minute (BPM) rate. It takes a shot at the standard of light regulation by blood course through finger at each heartbeat.

GSM MODEM

A GSM modem is a remote modem that works with a GSM remote system. A remote modem carries on like a dial-up modem. The fundamental distinction between them is that a dial-up modem sends and gets information through a settled phone line while a remote modem sends and gets information through radio waves. A GSM modem can be an outer gadget or a PC Card/PCMCIA Card. Normally, an outside GSM modem is associated with a PC through a serial link or a USB link. A GSM modem as a PC Card/PCMCIA Card is intended for use with a Workstation. It ought to be embedded into one of the PC Card/PCMCIA Card spaces of a Workstation. Like a GSM cell phone, a GSM modem requires a SIM card from a remote bearer with a specific end goal to work. As specified in before segments of this SMS instructional exercise, PCs use AT summons to control modems. Both GSM modems and dial-upmodems bolster a typical arrangement of standard AT summons. You can utilize a GSM modem simply like a dial-up modem

Introducing new TTL Modem with Dual band frequency of operation, SIM900A is a budget modem to fit applications requiring SMS/GPRS communication. The small form factor of our new SIM900A modem is suitable to fit it into small casing or space. It is also equipped with MIC29XX based high efficient low dropout regulator to enable the supply voltage to go as low as 4.5 Volt. The modem will operate reliably at 4.5 – 12 Volt range. 1 Ampere or more current should be provided for the GPRS applications.

Fig 3: SIM900A Modem

Fig 4: GSM modem applications

GSM SMS messaging can handle large number of transaction in a very short time. You can receive large number SMS messages on your server like e-mails without internet connectivity. E-mails normally get delayed a lot but SMS messages are almost instantaneous for instant transactions. Consider situation like shop owners doing credit card transaction with GSM technology instead of conventional landlines. Time you find local transaction servers busy as these servers use multiple telephone lines to take care of multiple transactions, whereas one GSM connection is enough to handle hundreds of transaction.

Liquid Crystal Displays (LCDs)

Liquid Crystal Displays (LCDs) have materials, which consolidate the properties of both Liquid and precious stones. Instead of having a dissolving point, they have a temperature extend inside which the atoms are nearly as versatile as they would be in a fluid, however are gathered together in an arranged shape like a precious stone. A LCD comprises of two glass boards, with the Liquid precious stone material sand witched in the middle of them. The inward surface of the glass plates are covered with straightforward anodes which characterize the character, images or examples to be shown polymeric layers are available in the middle of the cathodes and the Liquid gem, which makes the fluid gem particles to keep up a characterized introduction edge. One each polarizer are glued outside the two glass boards. This polarizer would turn the light beams going through them to an unequivocal point, in a specific course. At the point when the LCD is in the off state, light beams are pivoted by the two polarizer and the fluid gem, to such an extent that the light beams leave the LCD with no introduction, and thus the LCD seems straightforward. At the point when adequate voltage is connected to the terminals, the fluid precious stone particles would be adjusted in a particular bearing. The light beams going through the LCD would be pivoted by the polarizer,

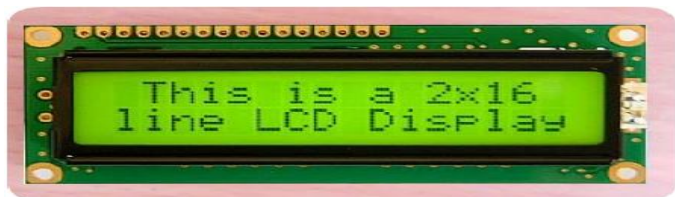which would bring about actuating/featuring the coveted characters.

Fig 5: LCD (Liquid Crystal Display)

LCD display use of our project title message and information message. Our project connect to a microcontroller unit data line connected to a 'PORT 2' and control lines connected to a P3.5,P3.6,P3.7.
BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. Piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufacturers and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of cooperative efforts by Japanese manufacturing companies.
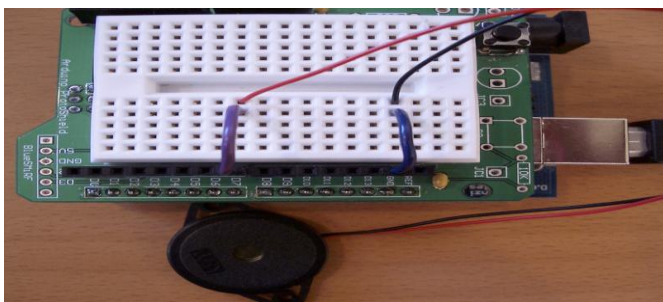

Fig 6: Piezo buzzer

While SMS is still a growing market, traditional SMS is becoming increasingly challenged by Internet Protocol-based messaging services such as Apple Inc.'s iMessage, Facebook Messenger, WhatsApp, Viber, WeChat (in China) and Line (in Japan), available on smart phones with data connections. It has been reported that over 97% of smart phone owners use alternative messaging services at least once a day. However, in the U.S. these Internet-based services haven't caught on as much, and SMS continues to be highly popular there. One of the reasons is because the top three American carriers have offered free SMS with almost all phone bundles since 2010, a stark contrast to Europe where SMS costs have been pricey.

SMS Enablement

SMS enablement allows individuals to send a SMS to a business phone number (traditional landline) and receive a SMS in return. Providing customers with the ability to text to a phone number allows organizations to offer new services that deliver value. Examples include chat bots, and text enabled customer service and call centers.
Message size

Transmission of short messages between the SMSC and the handset is done whenever using the Mobile Application Part (MAP) of the SS7 protocol. Messages are sent with the MAP MO- and MT-Forward SM operations, whose payload length is limited by the constraints of the signaling protocol to precisely 140 bytes (140 bytes * 8 bits / byte = 1120 bits). Short messages can be encoded using a variety of alphabets: the default GSM 7-bit alphabet, the 8-bit data alphabet, and the 16-bit UCS-2 alphabet. Depending on which alphabet the subscriber has configured in the handset, this leads to the maximum individual short message sizes of 160 7-bit characters, 140 8-bit characters, or 70 16-bit characters. GSM 7-bit alphabet support is mandatory for GSM handsets and network elements, but characters in languages such as Hindi, Arabic, Chinese, Korean, Japanese, or Cyrillic alphabet languages (e.g., Russian, Ukrainian, Serbian, Bulgarian, etc.) must be encoded using the 16-bit UCS-2 character encoding (see Unicode). Routing data and other metadata is additional to the payload size.

Interconnectivity with other networks

Message Service Centers communicate with the Public Land Mobile Network (PLMN) or PSTN via Interworking and Gateway MSCs. Subscriber-originated messages are transported from a handset to a service center, and may be destined for mobile users, subscribers on a fixed network, or Value-Added Service Providers (VASPs), also known as application-terminated. Subscriber-terminated messages are transported from the service center to the destination handset, and may originate from mobile users, from fixed network subscribers, or from other sources such as VASPs.

IV. DESIGN METHODOLOGY

In the proposed system we present a health monitoring system that uses the sensors for collecting data from patients, intelligently predicts patient's health status and provides feed-back to doctors through their mobile devices having android application. The patients will participate in the health care process by their mobile devices and thus can access their health information from anywhere any time.

Patient's data (temperature, heart rate, ECG, position) will be frequently measured and sent to server as shown in the figure. Period of sending (say every 1 min) can be set. Monitoring person learns patient specific threshold. Say the

regular body temperature of a patient is 24°C whereas one person feels feverish if his body temperature is 32°C. By employing an averaging technique over a relatively long time, Observer can learn these thresholds for patients. By using the system the healthcare professionals can monitor, diagnose, and advice their patients all the time. The health parameters data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time. Our system is simple and patient's data can be easily accessed.
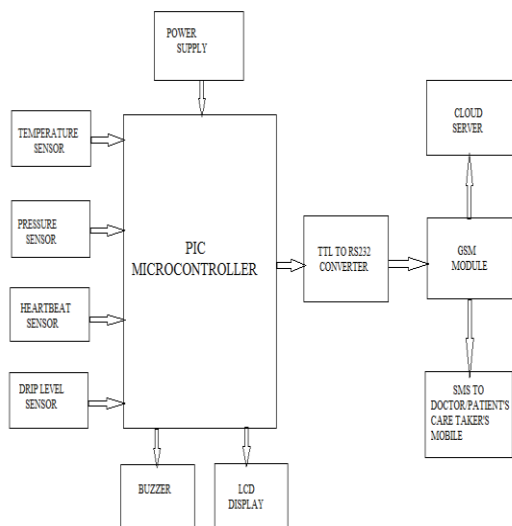
Fig 7: Receiver section of the proposed system

- In this design ,the PIC microcontroller is used as a gateway communicate to the various sensors such as temperature sensor, heartbeat sensor, ECG sensor, sensor for keeping a track of drip level(blood or saline).
- The microcontroller picks up the sensor data and sends it to the network through a Wi-fi and hence provides real time monitoring of the health care parameters for doctors.
- The controller is also connected with buzzer to alert the caretaker about variation in sensor output.
- At the time of extremity situation alert message is sent to the doctor through the android application connected to the cloud server.
- Hence quick provisional medication can be easily done by this system.
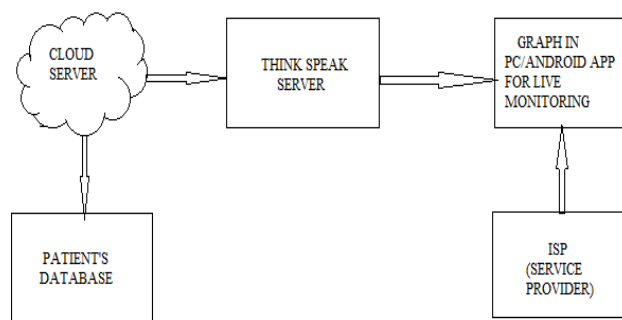

Fig8: Receiver section of the proposed system

- Also an additional subsystem is provided for prediction of heart disease for the patient based on his/her health parameters.
- This system is efficient with low power consumption capability, easy setup, high performance and time to time response.

V. RESULTS AND DISCUSSIONS

The square graph of this venture has been executed utilizing programming code in the mikroC PRO for PIC is an effective, include rich improvement device for PIC microcontrollers. It is intended to give the software engineer the least demanding conceivable answer for creating applications for implanted frameworks, without trading off execution or control.
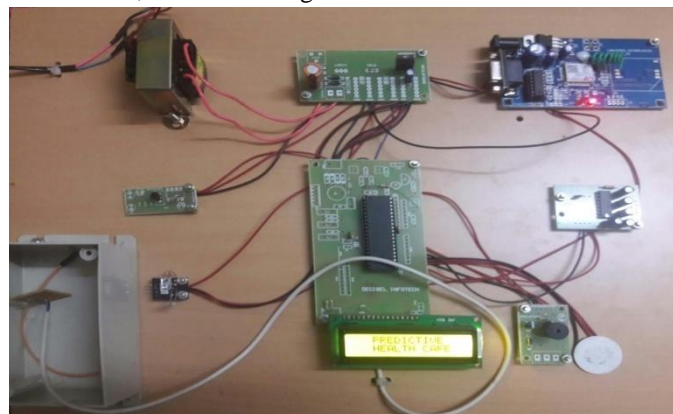

Fig9:Initial status of the hardware displaying the project name

At the initial stage it displays as shown in the Fig.11 ,where it displays the name of the project and hence runs to show as in the Fig.12,where it shows the values of the sensors which has been connected from the patient's body that has been connected to the microcontroller .
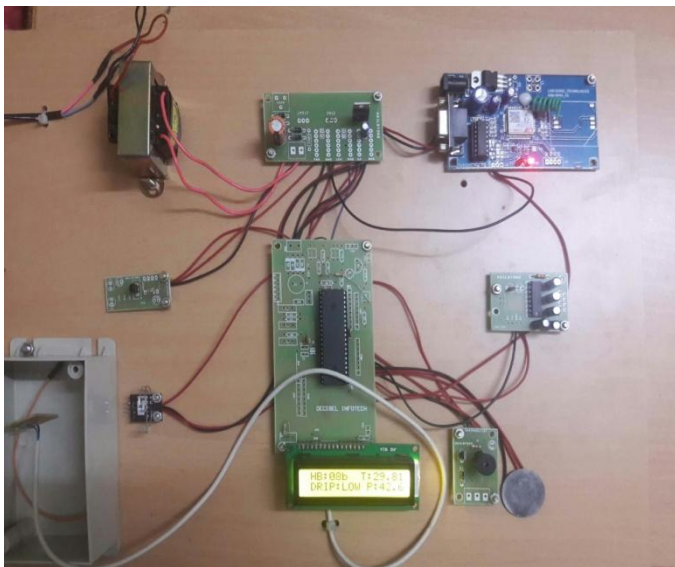
Fig10:Second stage of the hardware displaying the values of the parameters
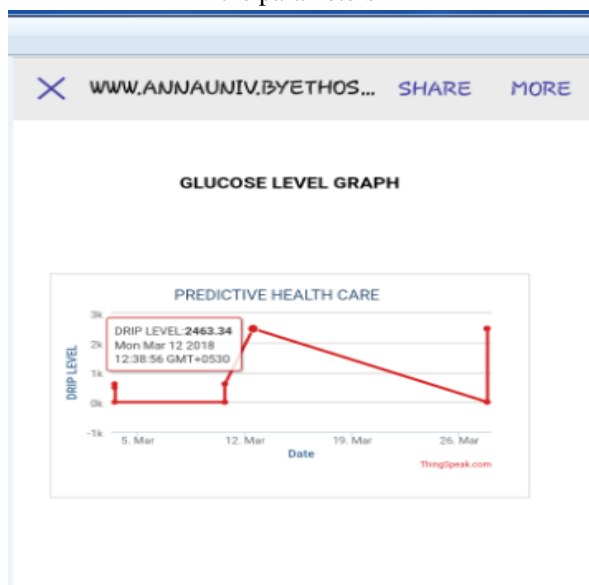

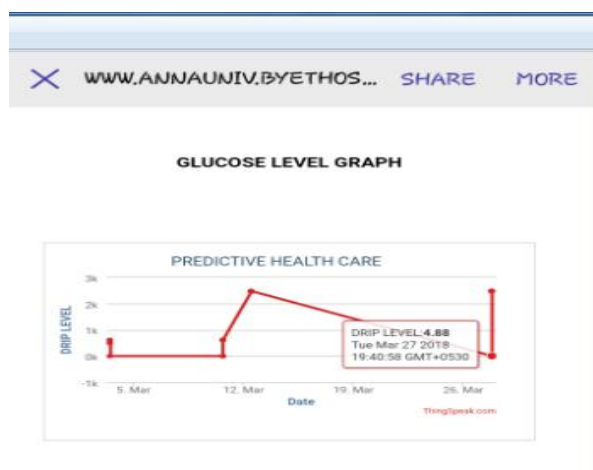Fig11: Displays the details of the glucose level on March'12 2018.

Fig12:displays the details of the glucose level on March'27 2018.

VI. CONCLUSION

By using the system the healthcare professional can monitor, diagnose and advise their patients all the time. The health parameters data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time. Our system is simple and patient's data can be easily accessed. The entire concept of IOT stands on sensors, gateway and wireless network which enable users to communicate and access the application/environment.

The Future work of the project is very essential in order to make the design system more advanced. In the designed system the enhancement would be connecting more sensors to internet which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and easy access. Establishing a Wi-Fi mesh type network to increase in the communication range.

VII. ACKNOWLEDGMENT

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