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Smart Health Monitoring System using IoT

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Abstract: ***IoT (Internet of things) has become an emerging topic in technological field research. It is basically interconnecting of devices with each other over the internet network. It facilitates the digitalization and automation of the manually operating devices. We typically think of the Internet of things (IoT) in terms of autonomous cars and smart homes, but some of the best and innovative applications of IoT technology are in fields that are intensely practical. One of the major is health care monitoring system. The main purpose of our project is the luxury to explore improved services for patients and their handlers. It can be used to promote basic nursing care in the hospital environment by improving the quality of medicare and patient safety. Rural area is lack behind from the proper patient monitoring system. So, remote monitoring and guidance awareness by sharing information in an authenticated manner are the main objectives of our project.***
Keywords: NodeMCU/ESP8266, Pulse Sensor, Arduino, LM-35, Thingspeak.

I. INTRODUCTION

Our project aims to develop new innovations for the use of basic nursing as well as personal care. In recent years, wireless technologies are gradually upholding various sectors. It is progressively gripping over the automation and control of various industrial sectors. Biomedical is one of the recent trending examples to provide better health care and monitoring. Not only in hospitals but also in the personal health care facilities are being enhanced by the IoT technology. In this paper, we introduce a secure IoT-based healthcare monitoring system. By implementing the nursing system will get a new dimension and every patient can be monitored remotely. It may play a vital role to reduce human effort, labor cost, rather will be easy to assess remotely anytime and will be helpful to take an immediate decision. Thus the nursing system will be digitalized. In day to day life, people are affected by various serious and complex diseases like Diabetic Mellitus, Cardio Vascular Diseases, and Hypertension, etc which are highly sensitive diseases. So, people are continuously anxious about their health condition. They need to consult with doctors, according to reports, and check up all of that. Internet of Things (IoT) is a growing present concept that has an effect on many aspects of human life. Various processes of different concepts including data acquisition, data transmission, and data analytics enable IoT based systems to support smart solutions especially for health care and monitoring. In IoT based system, the work progress depends on 3 system which is sensor work, getaway and cloud. Firstly, mention sensor network which is that the initiative for monitoring patients also as data collection. Secondly, the gateway system is a continuous connection network between sensors and cloud systems. It also reduces the valuable time for both patients and doctors. They don't need to wait for the reports because sensors are giving real-time data. The model is very effective for rural areas of people.

II. LITERATURE SURVEY

Nowadays increasing technology health experts are taking the great advantage of these electronic gadgets[3]. IoT (Internet of things) devices are highly used in the medical sector. In this paper, the project is about a health monitoring system. Especially, for Cardiac patients, High Blood pressure patients, hypertension problems, diabetic patients, etc. in rural areas because in rural areas the number of doctors is less than the urban area. In rural areas, medical equipment is not available except for government hospitals. So, the number of patients is higher than government hospital. Also, the equipment is expired in many cases. So, if any emergency call needed, this hardware device will immediately send the report to the doctors or intern doctors. Doctors will do the rest of the works by their reports.

Of many chronic illnesses, hypertension has become a common major disease that remains the route cause for cardiac/stroke mortality. But in present time, no remote HRV (Heart Rate Variability) analysis systems for hypertension patient available to help the doctors to track down the progression of the patient's condition or critical events in a rural area[4]. IoT is nothing but an advanced concept of ICT (Information Communication Technology) [5]. Raspberry pi component is more costly than the Arduino component device. Technologies are broadly expanded in a web-based or online system [6]. Now- a - days collecting real-time is vital. When the critical condition, patients are discharging from the hospital, he or she needs to check up on a regular basis. That is why IoT based health monitoring system is the best option for the rural areas.

The Internet of Things digitizes physical assets – sensors, devices, machines, gateways, and thus the network. It connects people to things and things to things in real-time. A typical IoT network can grow rapidly, leading to an experimental increase within the variety, velocity, and therefore the overall volume of knowledge . This data opens opportunities for significant value creation and revenue generation. But the important challenge for IoT environments is the way to analyze the massive volume of data from all sources and take action in real-time.

The complexity of IoT combined with the high expectations created by the web , Mobile, and 24x7 IT environments have made the necessity for brand spanking new analytics approaches and technologies more urgent. Achieving desired business objectives requires the power to act in real-time to require advantage of opportunities and address problems quickly.

In the pre-IoT era, a problem during a typical supply chain scenario might be addressed in 2-3 day cycles for satisfactory results. But in IoT, time to act is in minutes, seconds, or microseconds – half-hour to provision electric service, 30 seconds to act on information from devices, 5 milliseconds to address a security breach. This explosion of knowledge and therefore the high expectations within the IoT environment means the worth of knowledge will slip away quickly.

The importance of time-to-action for IoT applications are often seen during a big selection of applications and use cases. Broadly speaking, these applications are often grouped into three categories:

A. Operations and fulfillment are a convenient place to prove out efficiency gains.
B. Customer-focused sales and marketing applications have the potential to extend customer satisfaction and long-term growth.
C. Innovation in new products and services can drive new revenue and business value.

There also are specific use cases within these applications:

1) Predictive Maintenance
2) Demand/Supply Optimization
3) Predictive 1 to 1 Marketing
4) Outage Management Addressing the critical time-to-action requirement for these use cases and applications in IoT demands a complicated analytics solution that
a) Unifies historical, real-time streaming, predictive, and prescriptive analytics.
b) And provides faster analytics and smarter actions.

III. IOT HEALTH MONITORING SYSTEM

The project can be divided into two parts:

A. Data Collection Unit

For data collection, we are using the following sensors:

1) *Heart Beat Sensor:* The heart beat sensor is a plug and play heart rate sensor for Arduino. It is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor. It sips power with just 4mA current draws at 5V. For this, it is great for mobile application.

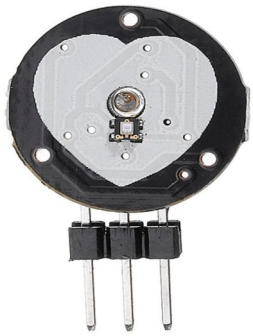

Fig1. Pulse Rate Sensor

2) LM35 Temperature Sensor: LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. E.g. 250 mV means 25°C. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C. LM35 gives temperature output which is more precise than thermistor output.

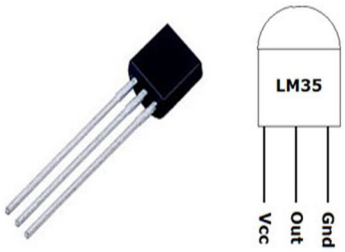

Fig2. LM-35 Temperature Sensor

IV. CONTROL UNIT

A. Arduino UNO

Arduino UNO is an open-source physical computing platform based on a simple I/O board and a development environment that implements the Processing/Wiring language. It can be used to develop stand-alone interactive objects or can be connected to software on computer. (for example: Flash, Processing, MaxMSP).

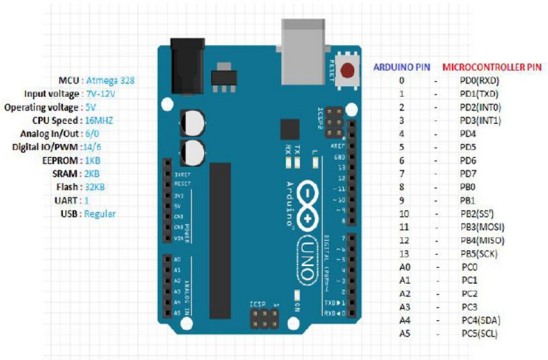

Fig3. Arduino UNO Board

B. NodeMCU Esp-8266 Module Version 3.0

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS.

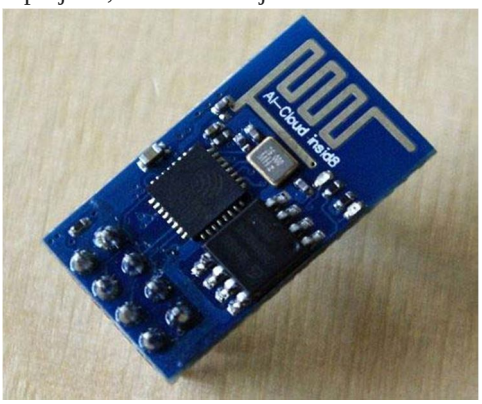

Fig4. ESP8266-01 Wifi Module/ NodeMCU

The control unit performs three tasks:

1) *Monitoring Data Collection:* For this task NodeMCU is being used, the values from the gas sensors are all being received on A0 and are controlled using D0, D1 and D2 pins. The DHT 11 output is connected at D8 pin.
2) *Monitoring Data Upload to Server:* Again for this task NodeMCU is being used which uses ESP 8266 Wi-Fi module. The values received from all the sensors are being uploaded to the server using the concept of IoT(Internet of Things) in this the device is connected to Wi-Fi with the help of esp8266 Wi- Fi module and the program written in it. The currently used server is ThingSpeak, which is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

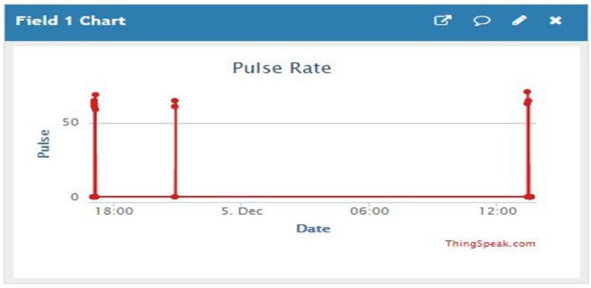

Fig5. Thingspeak Window

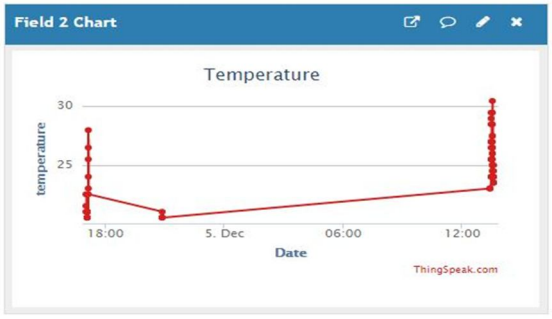

Fig6. Thingspeak Window

The data collected is uploaded to the server using internet on a public channel called 'HMS'. The data is represented in the form of charts and a complete database of all the charts (sensors) can be obtained here.

3) *Controlling the System and Its LCD Display:* For the LCD Display we use both the boards. The NodeMCU provides the Arduino signals regarding the condition of the food through pin D4 and D5 which are connected to pins 10 & 11 of the Arduino. The Arduino retrieves these signals and then displays the data on the LCD accordingly.

Serial Number	Patient ID	Pulse Rate	Temperature
1	ABC	64	26.96
2	ABC	69	27.94
3	ABC	59	22.06
4	ABC	69	25.49
5	ABC	62	26.96

Table1. Data Collected from the system.

The Arduino connections with LCD are as pin 12- LCD reset, 13- LCD enable, 5,4,3,2 for data. The LCD displays 'HEALTH MONITORING SYSTEM', 'BODY TEMPERATURE', and 'BPM' according to the received signal.

V. CONCLUSION

In general IoT based health care platform which connects with smart sensors attach with physical body for health monitoring for daily checkup. In this poject we proposed about IoT based patient monitoring system. The system technologies getting used by smart phones or gadgets in times where we also mentioned about advantages, challenges and opportunities. Due to the importance of observing medical patient, continuous remote monitoring is important . Our project work is giving the chance to watch patient continuously by using the online and apps service along side live monitor and mobile message service. This project also compared the early aged medical system between present time health monitoring. The present time represents the time reducing, reduce health care cost especially for rural area people.

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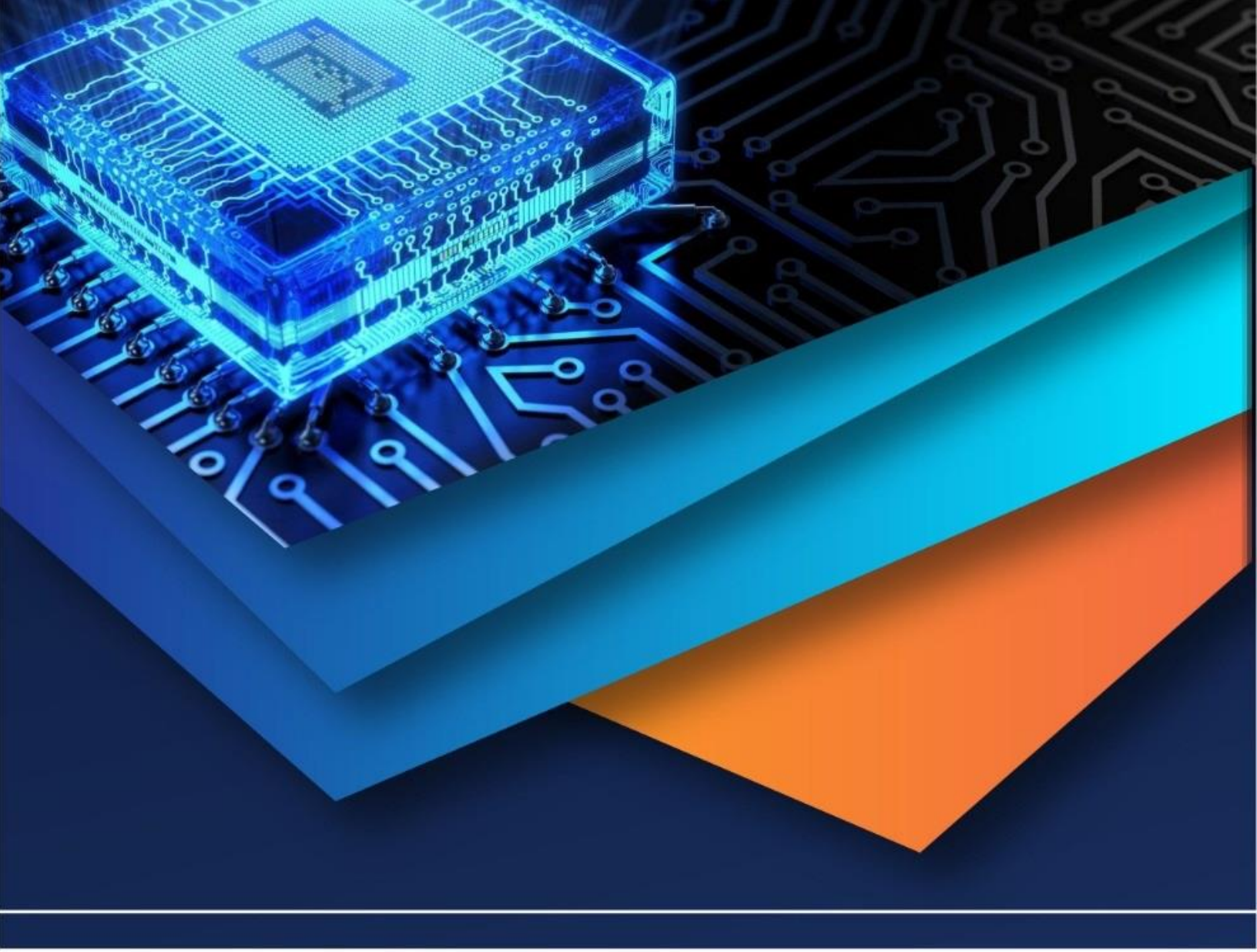

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