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Development of Scalable IoT Framework for Healthcare Monitoring

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ABSTRACT: With the inexorably quick paced lives and alarmingly high rate of unending diseases in the all inclusive community there is a requirement for animating the ebb and flow procedure of social insurance observing particularly in crisis circumstances. The current advancements in the correspondence innovation, particularly in the field of Internet of Things (IoT) have improved the availability of such frameworks. This can be accomplished by transferring the information of different wellbeing parameters measured by various physiological sensors on to the cloud stage, which later can be gotten to by the concerned restorative expert as of when required. The availability of information is additionally improved by the advancement of an Android based application, which will keep up a safe record of the information. The approach is shown with Raspberry Pi 3 as inserted stage interfaced with a physiological enhancer and ECG Module. The ECG checking application on Android gadgets will gather the bio-flag information from cloud and by performing with the essential investigation it will again transfer to the cloud in order to empower the sender to get master's recommendation/remarks.

KEYWORDS: Electrocardiogram(ECG), Internet of Things(IoT), Raspberry Pi 3**.**

I. INTRODUCTION

The Internet of Things (IoT) is characterized as an all inclusive system who can screens the physical questions by gathering, handling and breaking down the information over a system created by actuators or sensors or keen articles. Web of Things (IoT) is changing the route in which this present reality articles are cooperating with each other. The IoT idea can be connected to various regions like home robotization, medicinal services observing, savvy urban areas, keen assembling, automotives and some more. One of the ranges cantered in this paper is Healthcare. In medicinal services area, IoT idea can be utilized to screen the crucial indications of a patient at healing centres and at home**.**

Over the most recent couple of years, this field has pulled in wide consideration from specialists to address the capability of the IoT in the medicinal services field by considering different handy difficulties. As an outcome, there are currently various applications, administrations, and models in the field. Look into patterns in IoT-based human services incorporate system designs and stages, new administrations and applications, interoperability also, security, among others. What's more, strategies and rules have been created for sending the IoT innovation in the restorative field in numerous nations and associations over the world.

LITERATURE SURVEY:

Ning Lu et al. [2] focus on wireless technologies as well as the potential challenges to provide wireless solutions for vehicle to sensor, vehicle to Internet, vehicle to vehicle and vehicle to road infrastructure connectivity and identify future research issues for building connected vehicles. Andrea Zanella et al., in the paper [3] provide us a comprehensive survey of the technologies, enabling protocols and architecture for an urban IoT. Jianli Pan et al., [4] propose an IoT framework with smart location based energy control which uses cloud computing fundamentals and smart phone platform to enable multi-scale energy proportionality. This is done by building a proof of concept of IoT network and prototype of control-system. They carried out experiments that demonstrate the effectiveness of the proposed solution.

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II. CONCEPT OF IOT

A. What is the IoT?

The Internet of Things (IoT) alludes to the perpetually developing system of physical articles that element an IP address for web availability, and the correspondence that happens between these items and other Internet-empowered gadgets and frameworks. IoT is an interconnected system of items implanted with sensors, equipment, arrange availability furthermore, programming empowering them to transmit and get information. More than that, IoT structure empowers unification and trade of information between the fringe gadget and PCs. The IoT includes autonomous advancements that constitute the essential parts.

B. Growth of the IoT

By 2020, it is normal that the quantity of associated gadgets might be develop exponentially to 50 billion. For this developed primary driver is not human populace; rather it's gadgets which we utilized day by day (e.g. cooler, autos, fans, lights and so on.) and the new advances that are found in ventures are getting to be noticeably associated elements over the globe. This universe of interconnected things - where the people are connecting with the machines what's more, machines are conversing with different machines (M2M) is here and it is here to remain[4]. Numerous people consider that Machine-to-Machine (M2M) and IoT thought are one likewise, a comparative thing. Regardless, when in doubt we can express that M2M is subset of the IoT. The IoT is tremendous wrapping thought, which include Machine-to-Human correspondence (M2H), Radio Frequency Identification (RFID), Location-Based Services (LBS), Lab-on-a-Chip (LOC) sensors, Augmented Reality (AR), mechanical innovation and vehicle telemetric. A strong bit of these advances are the result of changes in military and present day store arrange applications; their customary segment is to combine introduced material things with correspondence learning, running data over a mix of wired and remote frameworks.

C. Healthcare and IoT

The IoT has been having effect on each field and industry et cetera human services as well. The IoT has different application in medicinal services observing, from remote checking to savvy sensors and medicinal gadget combination. On the off chance that we can give one of a kind ID to restorative gadgets we might have the capacity to associate these gadgets to web. By interfacing these gadgets to web we can get to these gadgets from anyplace to all over.

III. ELECTROCARDIOGRAM

Electrocardiogram (ECG) is the most vital term in restorative science and its recording, observing is valuable to have screen patients heart condition. An electrocardiogram (ECG) is a recording of the electrical movement on the body surface created by the heart. With each beat, an electrical motivation (or "wave") goes through the heart The privilege and left atria or upper chambers make the main wave called a "P wave" — taking after a level line when the electrical drive goes to the base chambers.

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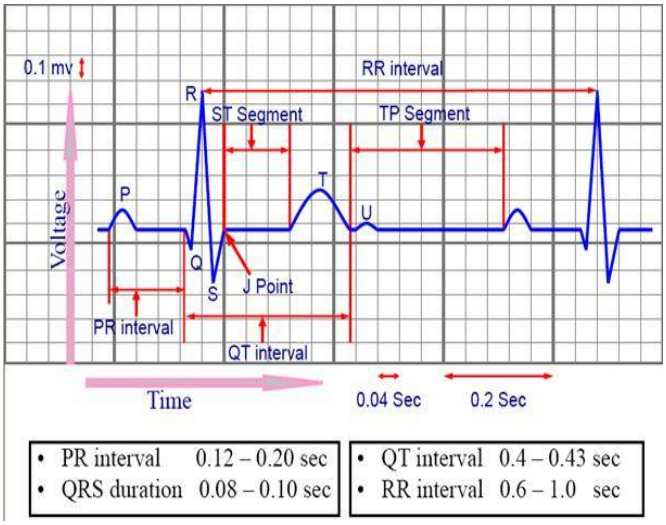

Fig.1: ECG waveform

The privilege and left base chambers or ventricles make the following wave called a "QRS complex." The last wave or "T wave" speaks to electrical recuperation or come back to a resting state for the ventricles. At that point the question comes as a top priority why is it done? Discovering to what extent a wave takes to go starting with one a player in the heart then onto the next shows if the electrical movement is typical or moderate, quick or sporadic. Second, by measuring the measure of electrical movement going through the heart muscle, a cardiologist might have the capacity to see whether parts of the heart are too substantial or are exhausted. The ECG demonstrates the best possible working of the heart as far as consistent heartbeats. The unfortunate heart has diverse sorts of ECG than a sound or ordinary heart. These heart maladies seen by utilizing P-wave, QRS complex and T-wave and its parameter as shown in fig.1.

IV. PROPOSED METHODOLOGY

The ECG information from the patient is being shown and recorded on the GUI for one minute. This information is then transferred to a cloud stage continuously. On the cloud server, client validation and approval gives an essential level of security and ensures the information [1]. Just the specialists, doctors and some other advantaged watchers will approach the patient's information. Web associated gadgets, acquainted with patients in different shapes, empower following wellbeing data what is indispensable for a few patients[2]. This makes an opening for more quick witted gadgets to convey more profitable information, decreasing the requirement for direct persistent medicinal services proficient connection. With quicker, better bits of knowledge, suppliers can enhance tolerant care, perpetual ailment administration, healing center organization and inventory network efficiencies, and give restorative administrations to more individuals at diminished expenses.

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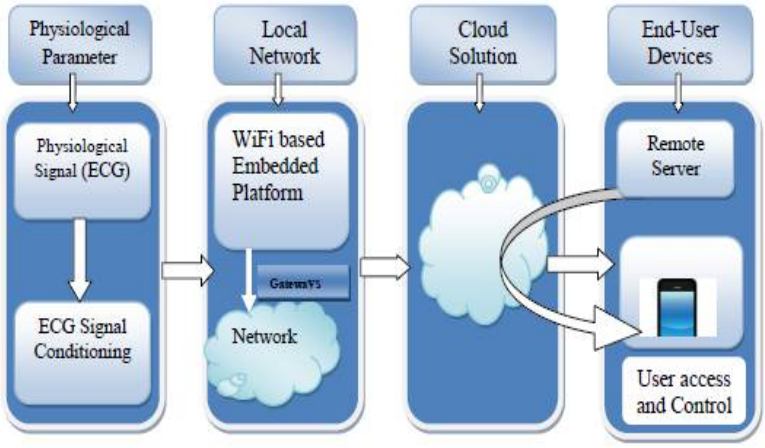

Fig.2: Proposed IoT Framework for Healthcare Monitoring

A. ECG Signal

The AD8232 as appeared in Fig. 3 is a Heart Rate Monitor. This is a savvy board used to quantify the electrical movement of the heart. This electrical action can be diagrammed as ECG and it's yield as a simple perusing. The ECG flag can be cloud, the AD8232 Heart Rate Monitor is goes about as an operation amp to get clear flag. The AD8232 is an incorporated flag melding obstruct for ECG and other biopotential estimation applications. It is intended to separate, open up, and channel little biopotential motions within the sight of loud conditions, for example, those made by movement or remote cathode position.

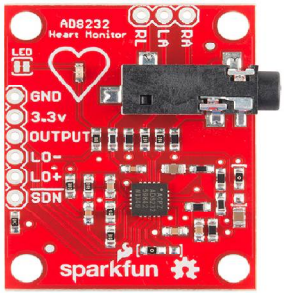

Fig.3: ECG Module AD8232

The AD8232 Heart Rate Monitor breaks out nine associations from the IC that you can patch pins, wires, or different connectors to. SDN, LO+, LO-, OUTPUT, 3.3V , GND give fundamental pins to working this screen with a Raspberry Pi 3 or other advancement board. Additionally given on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to connect. For advancement of an IoT system I am utilizing ECG application. For that I have to quantify an ECG of human body. Here I will utilize ECG sensor module AD8232 Fig.3 as it consolidates the majority of the components that are required in ECG estimation. The AD8232 empowers the improvement of versatile medicinal instrumentation frameworks at fundamentally lessened size, power, and general cost.

B. ADC MCP3008

As the ECG module AD8232 is giving a simple yield flag we require convert it in advanced arrangement to offer flag to the microcontroller. For this 10-bit ADC MCP3008 which good with Raspberry Pi 3 is utilized. It is a 16-stick IC with SPI convention as appeared in Fig.4. The CH0-CH7 (Pins 1-8) are the simple contributions for the MCP3008.

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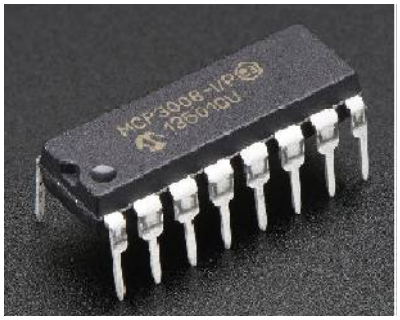

Fig.4: ADC MCP3008

The output of AD8232 is a analog signal. The microcontroller takes an digital signal as input so there is need of analog to digital converter. Here I am using ADC MCP3008 which has 10-bit resolution with SPI interface facility so that easily interface with microcontroller. The ADC AD8232 is interfaced with raspberry pi 3 using SPI communication protocol as shown in Fig.5.

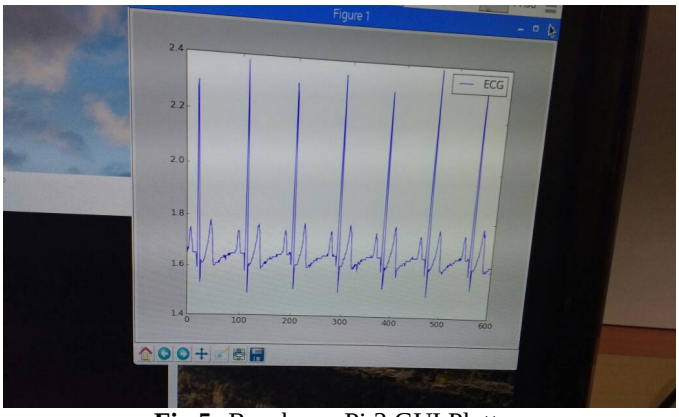

Fig.5: Raspberry Pi 3 GUI Plotter

V. RESULT

The following figure shows the ECG data displayed on Raspberry Pi 3 GUI. This ECG data from the circuit is transferred to the GUI using serial communication. The ECG data from GUI is uploaded to ThingSpeak shown in Fig.6 cloud platform using HTTP protocols.

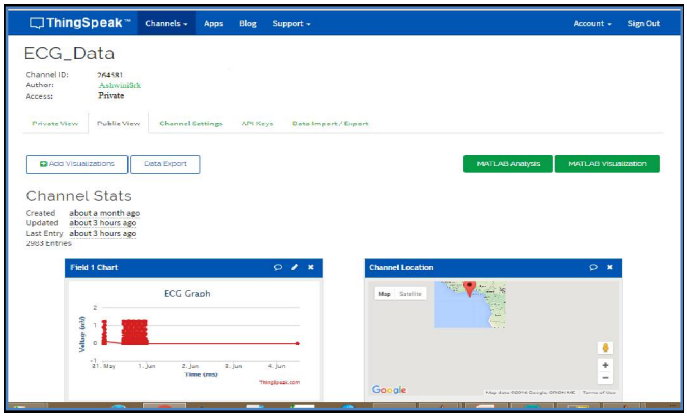

Fig.7: The ECG Graph on Thingspeak Platform

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VI. CONCLUSION

Electrocardiogram (ECG) has for quite some time been utilized as a significant therapeutic apparatus for checking the heart action of the patient. In a large portion of the cases, the patient needs to visit the healing center to record their ECG later to be investigated by the specialist. Utilizing the IoT idea, the excursions to the specialist will be lessened, since patients can transfer the vital data from the sensors to the cloud from their home which can be inspected and broke down by specialist remotely.

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