International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-5, June 2019

IoT & Wearable Devices

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Abstract*: This paper throws light on the concepts on IoT and its application in the wearable devices. The prototype proposed here is developed keeping in mind the concepts of IoT. Our proposed prototype is based on wearable form factor and drives on Li-ion batteries. Data from the local sensors are first collected in the IoT development board and then relayed to the mobile phone via internet connection. Here we have used the MQTT protocol as a mean of machine to machine communication. The main purpose of this prototype is to demonstrate basic architecture of the wearable devices and to enable further development through thorough development. Future of consumer electronics will be all about how we can make a device potable and moreover how much functionality will it provide.

***Index Terms*: IoT, MQTT.**

I. INTRODUCTION

Highlight Electronics devices industries have shifted from bulky equipment to portable equipment. If we go back ten years we saw that portable equipment was only talk on paper we never imagined that was possible this was because of the lack of technological advancements at that time. Major setbacks were seen the field of power dissipation or efficiency and performance of the system. Let's take a very basic example of laser emitter, we all know that laser based equipment were very hard to come across and they were very bulky throughout the advancements in the technology over the years engineers were finally be able to develop a much smaller compact laser emitter at very low cost, back in 1990's we used to play music on those bulky stereo system which usually cost us thousands of rupees but eventually its size and power that it consumed had to be reconsidered by the design them and over the years engineers were finally able to come up with much suitable portable music player we usually referred to it as MP3 player which play backed recorded music on a compact disc or dvd but it also had it problems with it so a little more effort was put on and eventually world was introduced to digital music players which used digital modulation and demodulation methods to record and playback audio signals most of them now these days comes with both audio and video feedback system. This was just one example like this there are many more. This brought a big revolution in the electronics manufacturing and consumer industry. Many of big companies thought of it as just a new way to increase their profit by increasing their profit by decreasing the size but some thought of it as a new way to improve basic existing systems by making them very small and power efficient and match them in performance up to the mark same way as the bigger counterpart. Medical equipment manufacturer have also been benefited with this advancement in the technology. As the years have passed a lot of changes have come across in the consumer electronics, there is a new breed of customers who wants there product not only portable but wearable form factor which has given rise to yet another form of race of advancement in the technology. Wearable devices are next phase of consumer products especially for fitness, military and IOT based applications. Advancement in the embedded system has made a major impact in this field; combining hardware with software to provide not only performance but higher usability experience, one of the best examples is the smart cellular phones, combining both capability of a mini computer and a simple cellular phone. Coming back to the wearable devices of the best suited example is the fitness band people are using these days to track their various health parameters and also keep track of the time. Given below are images taken from free google images of fitness band known as MI-band by Chinese company Xiaomi, which is by far most popular mobile and accessory brand in India.

II. BLOCK DIAGRAM

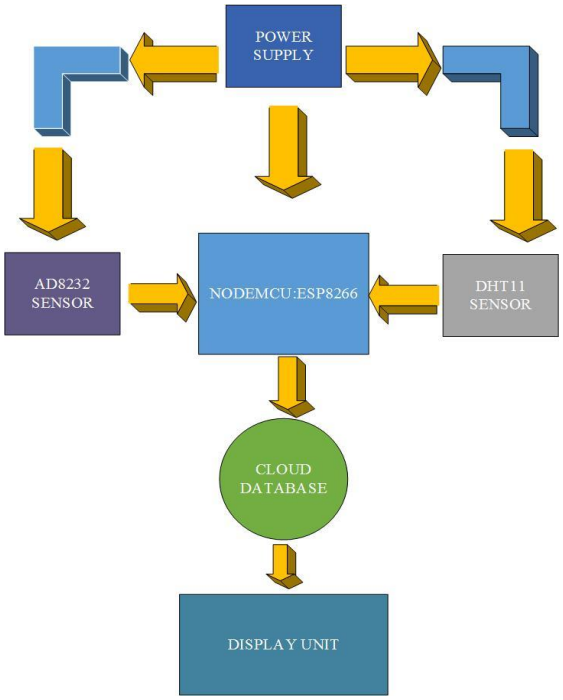

Figure 1: Block diagram

Manuscript published on 30 June 2019.
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A. POWER SUPPLY

First starting with "mother" system that is the power supply. There are three components that need the power supply connection. One is the main nodeMCU itself and other two are the sensor modules interacting with the nodeMCU. It's pretty simple in construct just needed two different output voltages that is 5 volt and 3.3 volt, or else we can just provide 5.0 volt to the nodeMCU and provide 3.3 volt to the sensors from the nodeMCU breakout board. In this project we used a voltage regulator LM317 which has an operating voltage from 1 to 37 voltage output well practically I have found that the maximum output voltage depends on the total amount of the input voltage.

B. AD8232

Very amazing small chip made by Texas instruments primary usage of this is converting muscular electrical impulses into analogue signals and send those impulses to the microcontroller for further processing. It is 6 pin chip form factor.

C. DHT11

Digital sensors are very handy when we have less analogue inputs pins in the microcontroller which also saves trouble for complex conversion algorithms to convert analogue data to its digital "readable" form. DHT11 is temperature sensor which has digital output it gives very precise reading about the temperature and does not require complex algorithm to read data. It's good for portable prototypes.

D. NodeMCU: ESP8266

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Espressif in Shanghai, China. It's a microcontroller with Wi-Fi capabilities.

E. CLOUD

Hard-drive and local storage are talks of past the next jump is the cloud storage, by saying cloud we comply that we store on a common server we can use to access the data anytime we want and also provide security. There are many ways to do it but in our project we do it in a very similar but different manner we use a cloud broker and view our result on a web socket.

F. DISPLAY UNIT

In our prototype version we have used smart cellular unit. However there are many versions of display units for example 16*2 LCD display is one of the most commonly used display units used in the prototypes.

III. IOT: INTERNET OF THINGS

This idea can be much well explained by a very interesting example. Imagine you are in middle of ocean and you find yourself among the pack of whale one thing you will very interesting is there mode of communication, for some people they sound like as if they are singing. What makes them very unique is their mode of communication. For us IoT is simply explained as mode of communication between two nodes/sensors/machines etc.

Our basic principle of operation is IoT. The wearable device prototype "talks" with the modern smart cellular phone and relays the sensor reading to the user. If we look at the history of this technology it takes us way back to the late 2000. To achieve this IoT functionality we require two things one is our "brain" that is the hardware, in our prototype variant we have used nodeMCU which is ESP8266 Wi-Fi enabled IoT development board and second part is the our "tongue" or simply we can say that our mode of communication. For the proposed device we have used the MQTT protocol which is "Message Queuing Telemetry Transport". It is an ISO standard protocol suit. For our medium we need a "broker", we subscribe to this broker's instance to publish and receive data.

There are certain steps that needed to be followed to realize the algorithm. Those steps are as follows:

1. We start by initiating our nodeMCU by providing it with the required SSID and password and thus connecting it with the network.
2. Next we create a broker instance and provide the server ID and password to the controller to publish the data.
3. After this we setup our mobile application by providing it with the instance name that needed to be subscribed.
4. At last we take the reading from the sensors and published them to the cloudMQTT, which is the broker we used in out prototype.
5. On user end application subscribes the instance and gets the output displayed.

IV. RESULT

Following table represents the experimental reading that was observed during the test time period. These reading are observed under normal conditions.

Time (Hour: minutes)	Temperature (Celsius)	Pulse (BPM)
9:00 AM	36	62
9:15 AM	36	63
9:30 AM	37	62
9:45 AM	36	62
10:00 AM	36	62
10:15 AM	36	61
10:30 AM	37	63
10:45 AM (probes disconnected)	31	1024

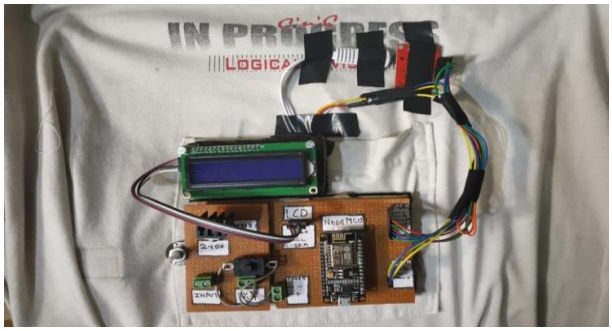

Figure 2: Hardware Assembly

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication (BEIESP)

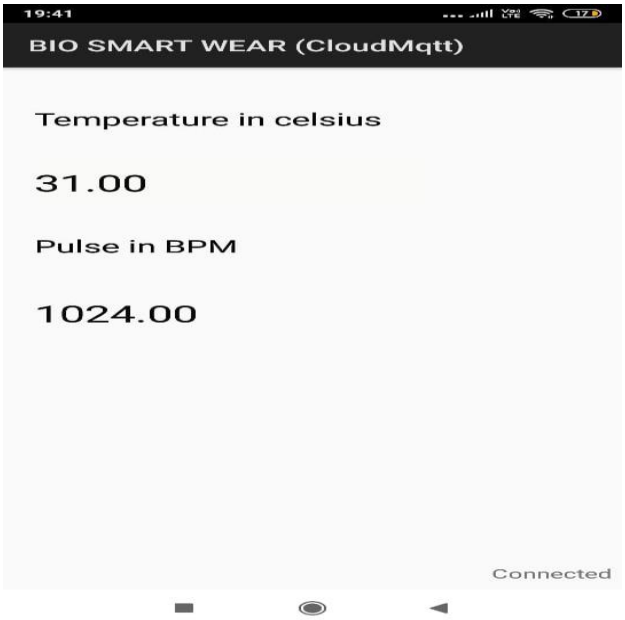

Figure 3: Mobile Application

Figure (b) and (c) are the final result of the assembly and the application output, the application is developed in the BASIC language.

V. CONCLUSION

With world shifting to smarter way of life it has become a prime task to provide compact and sustainable medical and fitness equipment. The whole idea of this project is to provide a wearable device at cheap cost to people who do not get proper medical services, to people who work under harsh and remote locations and to those who need continuous medical attention. The application of this project reaches far beyond just medical and fitness. This wearable device can be used to monitor geolocation of its user and that data can be accessed by their well-wishers also this project can be used by military after some modifications to monitor soldiers conditions in battlefield.

These are few examples how a small venture can make big difference. With improving technologies we might see a drastic change in wearable technologies as well which would benefit not only individual but society as well.

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Publication Details:

1. MICROWAVE ANTENNAS IN DEFENCE FOR ELECTRONIC WARFARE APPLICATION"by Hashpreet Singh, Amit Gupta, Sonali Dutta, A. Prabhakar,International Journal of Electrical, Electronics and Data Communication -ISSN: 2320-2084 Volume-2, Issue-3, March-2014 pp: (112-116).
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