

IOT BASED ASSESSMENT AND MONITORING SYSTEM FOR DIABETES PATIENTS

K.Geetha

Assistant Professor

Department of CS, CA & IT

Karagam Academy of Higher Education, Coimbatore, Tamil Nadu, India.

Abstract : Diabetes is a gathering of metabolic ailments wherein there are high glucose levels over a drawn out period. Long haul diabetes care requires inclusion from patients just as specialists and family parental figures. Inability to control the malady brings about long haul inconveniences as well as influences the life of the patients. On the off chance that the glucose level is observed step by step, it will assist the patient with managing their wellbeing appropriately. The input data in regards to their sugar level is useful for the patient to deal with the well being day by day. Right now talk about the framework that is intended to screen the glucose level, pulse and temperature of the individual. By making the information accessible in cloud, it tends to be utilized by the specialists to get the verifiable information. This will help better social insurance the executives of their patients. This framework is executed by utilizing the Raspberry Pi for perusing information from the client. With fast progressions in remote and web advancements, various applications dependent on Internet of Things have been proposed for the board of diabetes. The majority of these applications center around tolerant observing and innovation based dynamic. We investigate the working and fundamental engineering of these most recent applications and examine the significant issues and difficulties looked by them.

IndexTerms - Diabetes Mellitus, Deep Learning, Internet of Things, Lifestyle modifications.

I. INTRODUCTION

Diabetes is a metabolic issue that is described by high blood glucose and either lacking or inadequate insulin. Diabetes prompts visual impairment, renal disappointment, removal, cardiovascular failures and stroke. It is the third driving reason for death in many created nations. It is assessed that in 2010 there were internationally 285 million individuals (roughly 6.4% of the grown-up populace) experiencing this sickness. This number is assessed to increment to 430 million without better control or fix. A maturing populace and corpulence are two primary explanations behind the expansion. Besides, it has been demonstrated that practically half of the putative diabetics are not analyzed until 10 years after beginning of the malady; thus the genuine pervasiveness of worldwide diabetes must be cosmically high. Diabetes is extensively characterized into two: insulin – subordinate diabetes mellitus (IDDM) or Type I and non-insulin subordinate diabetes (NIDDM) or Type II. Type I diabetes chiefly happens in adolescence especially between 12-15 years age. Type II diabetes is the most widely recognized bookkeeping to 80 to 90% of the diabetic populace NIDDM happens in grown-ups (as a rule over 35 years) and is less extreme than IDDM.

Diabetes is treatable when it is analyzed before arriving at the risk zone; else it turns into a significant issue. There is a need to ceaselessly screen the blood glucose level to keep this ailment under control. Every day reflection and standard eating regimen will monitor the illness. Ongoing examination shows that utilizing diabetes self-administration frameworks help to control glycaemia and related blood glucose levels. Consequently, programming arrangements have been characterized for observing and displaying of blood glucose. Since these arrangements have the limitation of reliance on a PC, various types of arrangements closer to the client are being characterized, for example, glucometers coordinated in advanced photography and in phones, i.e., portable Health arrangements (m-Health). As of late, broad research work and framework tending to the structure and improvement of mHealth-based diabetes the executives frameworks have been seen.

Internet of things (IoT) [1]-[4] is one of the Major exchange moves-forward in near in time years that connections the net with every-day sensors and working apparatuses for an all-IP-based buildings and structure design, connecting physical and virtual things through the wrong use of persons of facts take and exchange powers. It is a network of present every-where apparatuses or things that are able of computation and exchange over the the net. the net of persons working together services and applications. putting to use the power of radio ad hoc [5]-[8] and sensor networks [9] and latest technologies like unclear computing [10] well-dressed apparatuses IoT is designing again current-day state of being healthy care with giving undertaking technology-based, goods/money making, and grouping hopes.

Over these years various social insurance applications [11]-[16] dependent on IoT have been proposed for diabetes the executives. This paper studies the most recent IoT based social insurance applications for diabetes the executives and audits the working and hidden structures. The paper talks about the significant issues and difficulties looked by them that incorporate innovative issues, well being, and security, protection, and trust, prompting new bits of knowledge and research headings in IoT. The primary target of this article is to help specialists in growing considerably more progressed and productive IoT based human services applications for diabetes the executives.

II. LITERATURE SURVEY

Abdalraouf H et al; had a framework which performs examination on unstructured information utilizing Recurrent Neural Network and Convolutional Neural Network, the prior neural system can separate high highlights however for immense pictures it requires various convolution and stacking of these pixels henceforth RNN is utilized alongside it which is conceivably done by utilizing solo neural language which helps preparing profound learning calculation at that point parameterizes then structure parameterizes with past data consolidates with set of maps learned by convolution layer through long transient memory. The

exhibition changed over various datasets for Standford Review it was 93.3% and Sentiment Trademark 48.8% packed however precision was 89.2%. It has a noteworthy job as far as parameters, creating convolution layer just as pooling layer[3].

Jaana L et al; built up a strategy of anticipating danger of diabetes put on diabetes chance score to forestall chance related with type - 2 diabetes which causes different incessant sicknesses in patients. An example was delivered which were of 35 years and 64 years determined to have type-2 diabetes and examination were finished utilizing multi-variation calculated relapse eventually appoints a parameter with score. This Risk Score was only whole of different factors proposed 2 years prior. The hazard score ran between 0 to 20 medication treated diabetes ≥ 9 , affectability of 0.78 and 0.81 and particularity of 0.77 and 0.76 prescient qualities 0.13.[4].

Alper Kursat U et al; built up a framework utilizing hereditary calculation arranged semantic highlights which are utilized for summing up content in content characterization calculations and contains choosing highlights from content. First phase of calculation is done utilizing cutting edge calculation. Second stage is completed utilizing idle semantic ordering entitled by hereditary calculation however result of these where compared to bigger values[5]. Yu Cheng et al; built up a hazard expectation framework which just accumulates and stores in cloud for example safeguarding records in electronic structure and such information protecting methods, inferring how we can gather designs from information out of which EHR(Electronic Health Record) is the effective system. Profound learning method has been applied over the information of EHR by doling out one measurement in a network and another measurement in another. Second layer is inferred because of convolution of first layer. Third layer is max pool layer which characterizes sparsity and Fourth layer is softmax forecast layer over which one can extricate patterns[6].

Sneha J et al performed forecast on Diabetes dataset utilizing Back propogation Neural Network which has 8 info and 1 yield layer, one shrouded layer with 10 neurons which was created utilizing MATLAB can get precise outcomes with assistance of GUI of patient's conclusion. The exactness rate is 81%[8]. Kanimozhi Selvi et al built up a framework which first trains the information afterward groups it. The dataset utilized was diabetes. The dataset is stacked into Hive and afterward arranged utilizing Naïve Bayes calculation. They had recently dissected yet additional data forecast was additionally conveyed out[9]. Kazemi, M et al; planned framework subtleties of wellbeing status of patients utilizing comfort inspecting techniques. Later on NDS(Neuropathy Disability Score) was regulated on 600 patients. In view of the score seriousness was ordered. With SVM technique, one-against-every one of the, one-against-one, three-part capacities and outspread premise were utilized to anticipate class of dataset. Manufactured minority oversampling strategy is utilized to improve the outcome[10].

Parisa P et al; a framework is structured which guarantees adjusted eating routine to be trailed by an individual so as to forestall high calories causing heftiness prompts interminable ailments so it will acknowledge the picture of nourishment and performs convolutional neural system on it perceives nourishment part and its substance and its precision came out as 99% [11].Senthil Kumar et al, has planned framework for dynamic dependent on clinical datasets-coronary illness, diabetes and hepatitis diabetes recovered from UC-Irvine and goal of framework is to sum up and separate the qualities gave by different calculations, for example, CART, C4.5 and ID3.In terms of multifaceted nature, C4.5 performs better than ID3 and CART performs better than all as far as efficiency[12].

III. METHODOLOGY

There are numerous frameworks intended for diabetic patients these days from looking at blood glucose till giving a help to driving better life. Right now, will be assembled utilizing pulse sensor, ECG sensor and Foot pressure sensor joined with temperature sensor. The above sensor esteems will be utilized in side effect evaluation which contains questions about whether patients have some other indications or unfortunate propensities. The indication appraisal information will be put away in a cloud server. A choice is made on the information put away in the cloud and recovered qualities are continue over examination so as to make patients to visit specialist or need to visit dietician.

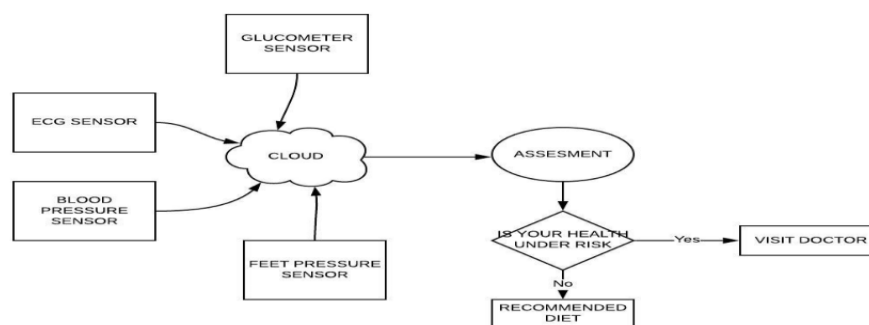


Fig. 1 Architecture

Sensors

Sensors utilized are glucometer sensor, circulatory strain sensors, ECG sensors, Feet Pressure Sensors.

- Glucometer Sensor: Glucometer Sensor permits client to screen their sugar levels either in fasting or post-lunch.
- Circulatory strain Sensor: Blood Pressure Sensor permits to accumulate perusing pulse of client so as to decide presence of hypertension.
- Feet Pressure Sensor: Feet Pressure Sensor permits to decide pressure in feet as for expanded degree of growing and it is implanted with temperature sensor which screens temperature of feet.
- ECG Sensor: ECG sensor screens the heartbeat of diabetic patient.

a) ONE TOUCH GLUCO MONITOR:**Fig 2 One Touch Glucose Monitor**

It is easy to utilize. It has sound alarms with shading and sound cautions. It is an ongoing item, in this undertaking we utilized for gluco observing by get its simple qualities. (Fig 2. one touch glucose screen) we utilize this one touch continuous item for getting the glucose level of the patients. We get the simple unit and force supply from that point we get the simple to advanced an incentive by arduino nano.

b) PULSE SENSOR**Fig 3 Pulse Sensor**

The beat sensor depends on the guideline of photograph phlethysmography. It quantifies the adjustment in volume of blood through any organ of the body which causes an adjustment in the light power through that organ (a vascular region).The beat perusing of the patient is perused by infrared lighting by focus the finger detecting . (Fig 3.pulse sensor)

c) TEMPERATURE AND BLOOD PRESSURE SENSOR:**Fig 4 Blood Pressure and Temperature Sensors**

A weight sensor is a gadget which detects weight and changes over it into a simple electric sign whose size relies on the weight applied. Since they convert pressure into an electrical sign, they are likewise named as weight transducers. A temperature sensor is an incorporated circuit, and can in this way incorporate broad sign preparing hardware inside a similar bundle as the sensor. There is no compelling reason to include pay circuits for temperature sensor Ics. This sensor is utilized to quantify the circulatory strain and temperature of the patients. (Fig 6.blood weight and temperature sensor)

D. RASPBERRY PI 3:**Fig 4. raspberry pi 3**

The Raspberry Pi board comes furnished with a SD card. This space licenses us to embed a SD card and that can utilize it as our gadgets. The SD card is a fundamental stockpiling gadget for Raspberry Pi board like a hard plate of a PC. The bootable Linux working framework is stacked onto the card, you are wanting to utilize. The Raspberry Pi underpins Linux, Qtonpi, ARM, Mac working frameworks. You can choose one OS; you should compose it to a SD card utilizing a Disk administrator application. You can likewise utilize other capacity system, as USB outside hard drive or USB drive.The raspberry pi 3 associated with a wifi. (Fig 7.raspberry pi) .we utilizing this Raspberry Pi controller for transfers the information readings of the patients into a cloud.

E. ARDUINO NANO:

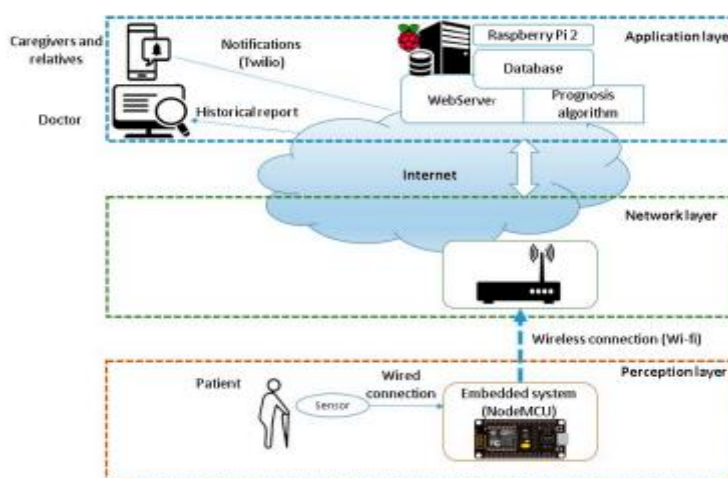


Fig 5.arduino nano

An Arduino is really a microcontroller based pack which can be either utilized legitimately by buying from the seller or can be made at home utilizing the parts, inferable from its open source equipment highlight. It is essentially utilized in correspondences and in controlling or working numerous gadgets. (Fig 8.arduino nano). We are utilizing this arduino for simple to advanced transformation of the information.

System Architecture:

The sensor is associated with an IoT gadget utilizing a wired association. When the chip is associated with the system, it handles the readings acquired by the sensor and sends them utilizing WiFi to a switch with a web association. The data is gotten by a server dependent on Raspberry Pi, where the calculation is put away. Here the information is handled to deliver an anticipation utilizing recorded information. Each perusing is sent to a web server to be shown.



Modules

- Information Collection and Storage: The framework includes gathering information from sensors like and later put away in cover over raspberry-pi.
- Calculation Formulation: A model is intended for hazard forecast with which can break down threat in diabetic condition so a profound learning with ideal layer is essential
- Need a Diet Recommendation: If the hazard factor is low then the framework will propose patient to go for diet suggestion.
- Input: The framework will get some information about their improvement in wellbeing, on the off chance that the status despite everything stay same, at that point framework will give certain tips to quiet.

Deep Learning

It is a piece of AI which mirrors the recreation of Human Brain. It utilizes this impersonation for handling information and creating designs which can be utilized in dynamic or potentially solo or unlabeled. Profound Learning contains neural system and it has layers of neurons or neural units which has conduct of human mind.

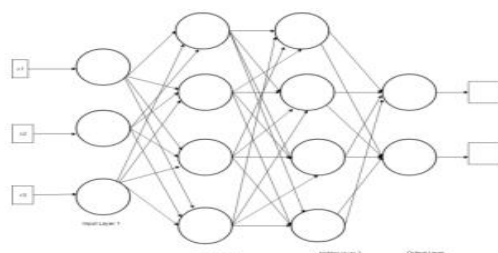


Fig 7: Deep Learning Process

1. Perception

Recognition is the original of neural system which has one information layer of some appearance and yield layer alongside loads. The inconvenience its capacity to deal with directly distinct capacities however unfit to deal with non-straight detachable capacities.

2. Multilayer Perceptron:

Multilayer Perceptron is up and coming age of neural system which has input layer and a yield layer and concealed layer. It is a kind of feed forward neural system In this calculation each hub chips away at actuation work for preparing information it utilizes back propogation strategy. It recognizes in such a manner as though it shows up as non-straightly distinct.

$$y(v_i) = \tanh(v_i) \text{ and } y(v_i) = (1 + e^{-v_i})^{-1} \dots (1)$$

3. Back-propagation

Back propagation is an artificial neural network based on overseen learning view. It has three levels: input, out-put in between levels and out-put present in in existence without being seen covering, board. weights between input to out-put in between levels are brought up to the current state so that error takes place at each computation will be small. The limiting conditions of back-propagation are: nearby minima, network paralysis and slow confluence.

4. Recurrent Neural Network

Repetitive Neural Network is another profound learning procedure which creates edges of items in a picture by taking care of the contribution to the inside same layer however in another progression as opposed to stacking it in another layer. It is likewise utilized in distinguishing designs from discourse info or content documents. The idea behind RNNs is to use progressive information. RNNs are considered discontinuous considering the way that they play out a comparative endeavor for every part of a gathering, with the yield being depended upon the past counts. Another way to deal with consider RNNs is connected to having a memory which gets information about what has been resolved up until this point. A repetitive neural system and the spreading out in time of the count related with its forward estimation.

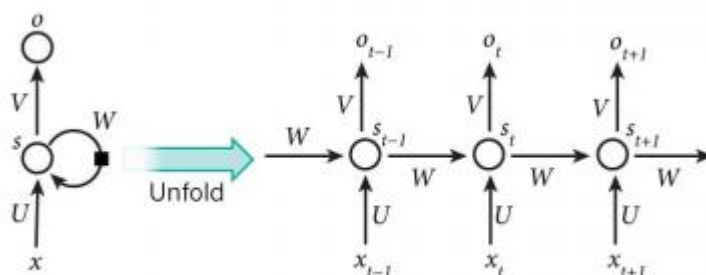


Fig.8 RNN Computation

x_t is the contribution at time step t . For instance, x_{-1} could be a one-hot vector comparing to the second expression of a sentence. s_t is the shrouded state at time step t . It's the "memory" of the system. s_t is determined dependent on the past shrouded state and the contribution at the present advance: $s_t = f(Ux_t + Ws_{t-1})$. The capacity f for the most part is a nonlinearity, for example, \tanh or ReLU . s_{-1} , which is required to figure the primary concealed state, is ordinarily introduced to all zeroes. o_t is the yield at step t . For instance, on the off chance that we needed to foresee the following word in a sentence it would be a vector of probabilities over our jargon. $o_t = \text{softmax}(Vs_t)$.

IV EXPERIMENTS AND RESULTS

The gadget has been planned and sensor information are put away and seen on Thingspeak cloud. Utilizing Weka instrument perception has been got utilizing Multilayer Perceptron Algorithm



Fig.9 Data in cloud

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In [28]: print(classification_report(y_test, predictions))
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	precision	recall	f1-score	support
0	1.00	0.10	0.18	40
1	0.41	1.00	0.58	25
micro avg	0.45	0.45	0.45	65
macro avg	0.70	0.55	0.38	65
weighted avg	0.77	0.45	0.34	65

Fig.10 Risk Analysis in WEKA

The dataset has seven properties – ECG, Blood Pressure, Feet Pressure, Glucose and BMI esteems. It was broke down utilizing multilayer perceptron. The calculation had one straight with 195 examples its precision was 0.65 for test 0.63. All out Number of occurrences are 260. During arrangement fit the average(micro average):0.45 and full scale normal is 0.70. The hazard evaluation is done utilizing Python Programming in Jupyter journal. Hazard is contrasted and BMI i.e.if an individual is stout or overweight (≥ 25 or ≥ 25 and ≤ 30) at that point they have odds of high sugar and at last can have high danger of neurological issues like stroke, loss of motion and so on or can have cardiovascular issues. Subsequently it is important to avoid potential risk connected at the hip that is diet just as prescriptions appropriately. Yet, for the individuals who are overweight and whose blood glucose is less or inside range like (5.0 or under 5.0 according to HbA1C) they can experience dietary alterations and way of life changes.

V CONCLUSION

In the current human services observing framework, we will consistently screen the patient's pulse, temperature, and meds devoured by utilizing a web application. We have furthermore utilized the heap cell sensor to monitor medication consumption by the patient. The framework can do long haul observing on patient's condition and is outfitted with a crisis salvage instrument. Future degree is add more sensors to the framework so as to improve the human services parameters. We expect that our framework will beat different existing issues and will work productively. Our framework will include one stage towards the advancement of a superior human services framework.

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