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Compressed Sensing for IOT Application

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ABSTRACT:

In remote sensing network, the data retrieved by the sensors are in continuous nature which consumes large amount of power and also memory for storage. It is also difficult to maintain such a tremendous data. These are some problems which we are facing in remote sensing. To overcome this problem we can use compressed sensing for IOT application. Compressive Sensing (CS) as a novel as well as effective signal transform technology in order to save cost of sensors in the process of transmitting information and gathering data. It is possible to create standalone and net oriented application in Internet of Things (IOT).The Internet of Things (IOT) is a fast developing area which has a huge scope. Its primary aim, that of connecting even the most mundane objects to provide a comfortable lifestyle.This paper provides an idea that how compressed sensing can used into data sampling and acquisition in wireless sensor networks and IOT and also to check humidity and temperature from the environment and also used compressed sensing algorithm for processing sensors data.

Keywords :–

Compression-sensing, Temperature and humidity sensors ,Processor, Internet-of-Things.

I.INTRODUCTION

The compressed sensing (CS) theory is able to reduce sampling points which is associated with the volume of data collected so that the part of the redundant data is never acquired. This paper provides an idea that how CS can used into data sampling and acquisition in wireless sensor networks and IoT. For experimental evaluation, we are using two sensors, one is humidity sensor and other is temperature sensor, we are taking output from the sensors and efficiently data is transmitted with minimum cost.

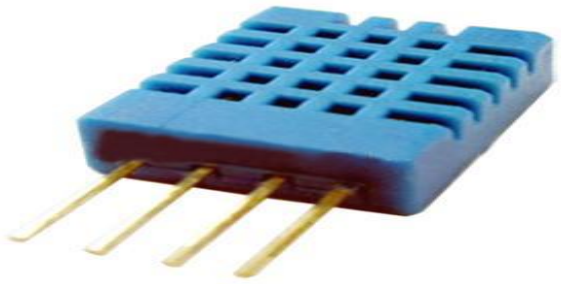

Fig.1 :DHT 11 Humidity & Temperature Sensor

For processing signal from sensors, we use Raspberry Pi processor(fig.1). The Raspberry Pi is a low cost single-board computer which is controlled by a modified version of Debian Linux optimized for the ARM architecture. The setting up of Raspberry Pi consists of selecting raspbian OS from noobs package[1]. The noobs package consists of raspbian, arclinux, pidora, open ELEC, risc OS operating system. this information is further provided to the computer server using wireless connection. Next step is to display a result on android application as well as on the desktop.In this compressed sensing we can use various algorithm but here we are using the algorithm “Regression based algorithm” and we are using “Sparse matrix based algorithm”.

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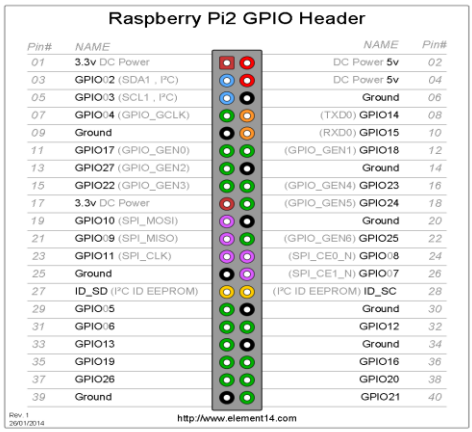

Fig 2:Raspberry Pi Pin Diagram

II. LITERATURE SURVEY

The literature review plays a most important role in the research process. It is a source from where research ideas are taken and developed into concepts and finally theories. It also provides the researcher short information about the research done in that area so far. In compressed sensing, a sparse signal is collected and compressed into a set of measurements, where is typically much smaller than original data. If these measurements are taken appropriately, then it is possible to regain from this small set of measurements using a variety of polynomial-time algorithms .Compressed sensing is an attractive approach for sensor networks, where measurement capabilities may be limited due to both coverage and energy constraints. Recent works have shown that compressed sensing is applicable to a variety of sensor networks problems including event detection [2], Compressed sensing (CS) has been drawing increasing attention in the wireless telemonitoring of physiological signals as an rising data compression methodology. It has been shown that Compressed sensing, compared to traditional data compression methodologies, consumes much less energy and power, saves lots of computational resources [4].

III. PROPOSED SYSTEM

Our proposed system incorporates Compressed sensing for IOT application. The data is collected from environment by temperature and humidity sensors. There is huge amount of data collected from sensors time to time the big amount of data will be compressed by using compression techniques by applying certain algorithm. The compressed data will be the output of processor. The output will be display on the system as desktop or mobile.

Features of proposed system

- Achieve accuracy using low energy in sensor network.
- To check humidity and temperature from the environment.
- Using Wi-Fi and raspberry microprocessor.
- User defined algorithm for processing sensors data.

Fig.2 showing the architecture of Compressed Sensing For IOT application.

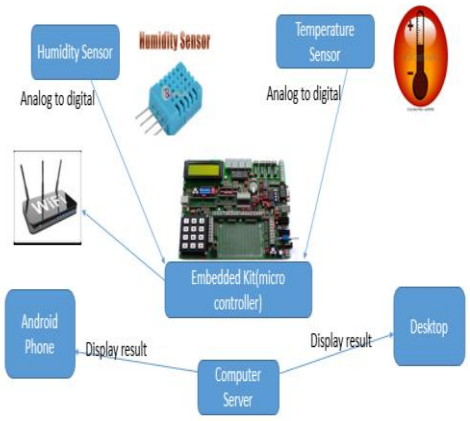

Fig:3

IV.ALGORITHMS

Sparse matrix based algorithm:-

Sparse matrix is a matrix in which most of elements are zero. By contrast, if most of the elements are nonzero, then matrix is considered dense. Sparse matrix obtained when solving a finite element problem in two dimensions.

Advantages:

- **Memory Management**:

To store data that contains a large no of zero valued elements can both save significant amount of memory of speed up the processing of that data.

- **Computational Efficiency**:

Reduce computation time by eliminating operation on Zero elements

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STEPS:

1. Install 'n' sensors in an area.(say n=25)
2. Create m*m square matrix such that m * m = n (m=5), where each element represents a sensor(or it's value).
3. Take initial readings from the sensor as shown below:

$$X0=\begin{pmatrix} a1 & a2 & a3 & a4 & a5 \\ a6 & a7 & a8 & a9 & a10 \\ a11 & a12 & a13 & a14 & a15 \\ a16 & a17 & a18 & a19 & a20 \\ a21 & a22 & a23 & a24 & a25 \end{pmatrix}$$

where a1 to a25 represents sensors.

4. Now after a specific interval, record another reading in matrix X1.

$$X1=\begin{pmatrix} b1 & b2 & b3 & b4 & b5 \\ b6 & b7 & b8 & b9 & b10 \\ b11 & b12 & b13 & b14 & b15 \\ b16 & b17 & b18 & b19 & b20 \\ b21 & b22 & b23 & b24 & b25 \end{pmatrix}$$

5. Calculate the difference in temperature detected in the different interval of time as:

$$X3=X0-X1=$$

$$\begin{pmatrix} a1 & a2 & a3 & a4 & a5 \\ a6 & a7 & a8 & a9 & a10 \\ a11 & a12 & a13 & a14 & a15 \\ a16 & a17 & a18 & a19 & a20 \\ a21 & a22 & a23 & a24 & a25 \end{pmatrix} - \begin{pmatrix} b1 & b2 & b3 & b4 & b5 \\ b6 & b7 & b8 & b9 & b1 \\ b11 & b12 & b13 & b14 & b15 \\ b16 & b17 & b18 & b19 & b20 \\ b21 & b22 & b23 & b24 & b25 \end{pmatrix}$$

6. If there is no change in temperature then the value of that element in the resultant matrix X_3 will be zero.
7. Create a sparse matrix if number of non zero elements are less than number of elements having value zero.
8. Send this sparse matrix to system to store or display.
9. Continue this process after every specific interval.

Regression based algorithm:-

In standard regression, a response variable *is* associated with the input variables, where input is independent, mean zero additive noise variables. In compressed regression, we assume that the response is also compressed, resulting in the transformed response. Regression is tries to find the relationship between dependent variable and one or more independent variable.

Advantages:-

- **Accuracy of result:-**

Regression analysis allows manages to established objective measures of relationship between the independent and the dependent variables.

- **Use of multi-variable**:-

The multiple regression analysis models allow manages to test for several independent that may explain different things about dependent variable.

- **Predicting the future.**
- **Correcting error.**
- **Supporting decisions**.

STEPS:

1. Install 'n' sensors in an area.
2. Find the sensor whose value is to be predicted according to its related sensors (say x_0).
3. Calculate it's (x_0) value by averaging method.

$$X_0 = \{^{n}\sum_{i=1} [f(x_i)*Dist(x_i,x_0)]\}/N$$

where $f(x_i)$ is the value read by sensor(humidity or temperature),

$$Dist(x_i,x_0) = \begin{cases} ((x2-x1)^2 + (y2-y1)^2)^{1/2} \\ 0, \text{if } (Dist(x_i,x_0) > 5), \end{cases}$$

and N is number of sensors for whose $Dist(x_i,x_0)>5$

4. .Send this value to server.

V. CONCLUSION AND FUTURE WORK

Compressed sensing approaches presented in this paper will results into minimization of data transfer from remote area to server. Also high data rate might not possible from remote places, where this approach is suitable. Future work includes testing and evaluation of proposed algorithms in real world environment.

VI. REFERENCES

[1] Upton, E., & Halfacree, G. (2014). Raspberry Pi user guide. John Wiley & Sons Patterson,

[2] S., Eldar, Y. C., & Keidar, I. (2014). Distributed compressed sensing for static and time-varying networks. Signal Processing, IEEE Transactions on, 62(19), 4931-4946.

[3] Han, P., Niu, R., & Ren, M. (2014). Distributed Approximate Message Passing for Compressed Sensing. arXiv preprint arXiv:1404.3766.

[4] Zhang, Z., Jung, T. P., Makeig, S., Pi, Z., & Rao, B. (2014). Spatiotemporal sparse Bayesian learning with applications to compressed sensing of multichannel physiological signals. Neural Systems and Rehabilitation Engineering, IEEE Transactions on, 22(6), 1186-1197. Zhilin Zhang, *Member*, *IEEE*, Tzyy-Ping Jung,

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