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Application of Cloud Computing in Sericulture Monitoring

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Abstract- Cloud computing has becoming beneficial to various users in different fields. Many cloud providers are now providing various services to facilitate the user needs. Storage of measurement data is a very important aspect in various measurement and monitoring applications. This paper discusses the application of cloud computing in sericulture monitoring. In sericulture farms, most important factors in environment that influence the physiology of insects are temperature and humidity. Air temperature and relative humidity determines the growth of silkworm and the quantity and quality of cocoons. Farmers are really needs to take care about the measurement of temperature and relative humidity in silkworm rearing environment. This study focuses on analyzing and implementing cloud computing for sericulture monitoring application. Air temperature and relative humidity are measured and updated to a cloud service provider. From the cloud storage data are viewed through mobile phone, laptop or PC with internet connectivity. Hardware and software development of system are discussed. Typical measurements with the present system are reported.

Key words - Cloud computing, farm management, silkworm, sericulture, Microcontroller.

I. Introduction

Cloud Computing has recently emerged as a compelling paradigm for managing and delivering services over the internet. This means that software, hardware and network resources are centrally managed. The rise of Cloud Computing is rapidly changing the landscape of information technology, and ultimately turning the long-held promise of utility computing into a reality. Cloud computing promises to deliver reliable services through next-generation data centers built on virtualized compute and storage technologies. Users will be able to access applications and data from a Cloud anywhere in the world following the pay-as you-go financial model. Clouds are classified according to their deployment models as private, community, public and hybrid Clouds. Clouds also offer different service models; software, platform and infrastructure as service [1]. Cloud computing is applied in various fields. Xia et al (2013) developed a cloud based real-time ECG monitoring system [2]. R. Deepa and K. Boopathi (2014) developed a remote healthcare monitoring system based on cloud computing and refer it as cloud care [3]. G. Sahoo et al (2013) briefly reported the challenges and role of cloud computing in agriculture sector [4]. S. Jeong et al (2013) deployed cloud computing based livestock monitoring and disease forecasting system [5]. Cloud users select their respective cloud based on the services. In this present work platform as a service is taken into account and utilized for sericulture monitoring application.

II. RELATED WORKS

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Sericulture or silk farming is an agro-based industry, involves rearing of silkworms for the production of raw silk. Silkworms are very delicate and sensitive to environmental fluctuations and are unable to survive naturally since their domestication during ancient times. Thus, the adaptability to environmental conditions in the silkworm is quite different from those of wild insects. It is important that in the course of rearing silkworms, the temperature should not fall below 20 °C or rise above 30 °C and the recommended relative humidity is in the range of 70 – 90 %. It should be noted that every moult i.e. growth stage of a silkworm requires the environmental parameters to be maintained at certain levels to achieve an optimum yield [6, 7]. Hence, it is essential to monitor the temperature and relative humidity inside silkworm rearing house. In typical sericulture farms, the temperature and relative humidity is measured using wet-and-dry bulb thermometer and recorded manually four times a day at 6:00 hrs, 10:00 hrs, 14:00 hrs and 22:00 hrs for thirty days.

Y.K Peng and M. Ohura (2000) developed an automated system to monitor and control the air temperature and relative humidity inside a silkworm rearing house. The system measures the temperature and humidity and records the data in a computer and sends the data to the intended users by E-mail [8]. N. Raste et al (2014) developed an intelligent automation system that measures and maintains the temperature and humidity inside the rearing house at optimum levels for the particular moult of the silkworm house [9]. M. Ohura (2003) developed a PLC based system to automate the rearing house. The system uses a PC to provide the control instructions. Temperature and relative humidity inside the rearing house are also monitored [10]. From the existing works it is observed that most of the time data is utilized by particular farm users. By providing the measurement to cloud the data is stored in cloud and making data analysis is done anywhere the user has internet connectivity. This is the first of its kind in integrating cloud computing and sericulture monitoring. A novel approach has been deployed by utilizing platform as a service provided by manylabs in sericulture parameter monitoring.

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III. SYSTEM DESIGN

Fig. 1. Show the block diagram of the cloud based system. The system consists of a data acquisition system comprising of sensors, signal conditioners, LCD and Atmega328 microcontroller. The microcontroller reads the sensor data and converts the data to required temperature and relative humidity data. Every 30 seconds the measurement data is updated to a PC and LCD. In the PC a python script is executed and the script reads the data from microcontroller and updates the data to cloud service provider.

IV. HARDWARE DESCRIPTION

Fig.2 shows the circuit diagram of the data acquisition system. IC LM35 is used for temperature measurement and SY-HS-220 is used for relative humidity measurement. LM35 provides 10mV/°C. Output of LM35 sensor is further amplified using LM358 operational amplifier with a gain of 11. Amplified output is applied at the A0 pin of the Atmega328. SY-HS-220 provides 0.033 V/RH. The output is buffered using LM358 and applied at the A1 pin of the Atmega328. ATmega328 has 6 channel 10-bit built-in ADC and reference voltage for the ADC is 5V. A 16X2 LCD is used to indicate the updated value in the silkworm rearing environment.

V. FIRMWARE DESCRIPTION

Firmware for the Atmega328 is written in ‘C’ under Arduino IDE. The firmware first initializes the UART for 9600 baud rate. It configures analog channels A0 and A1. Then it reads the analog data and converts the data to voltage. Converted voltage is then converted in to required measurement units and it is further converted as a data packet as shown in Table I below. The data packet is then updated to a LCD and PC and 30 sec intervals.

TABLE I Format of data packet

Parameter1	Value1	Data separator	Parameter2	Value2
Temperature:	33.59	,	Humidity:	90.88

VI. PYTHON SCRIPTING

Python scripts running on the PC reads the data from the serial port and make it as a data packet. Data packet received is updated to the cloud provider to the Data set ID assigned. After the insertion of data an acknowledgement is received. Current e-Governance scenario in healthcare sector

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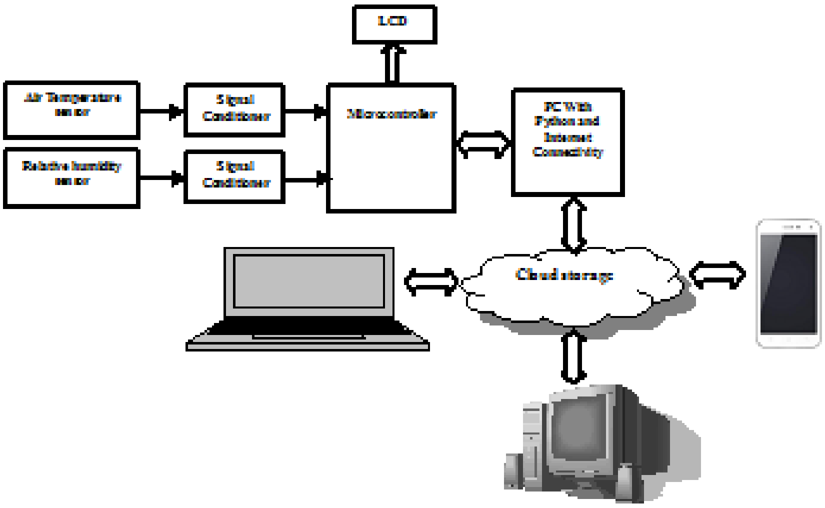

Fig. 1. Block diagram of the cloud based measurement system

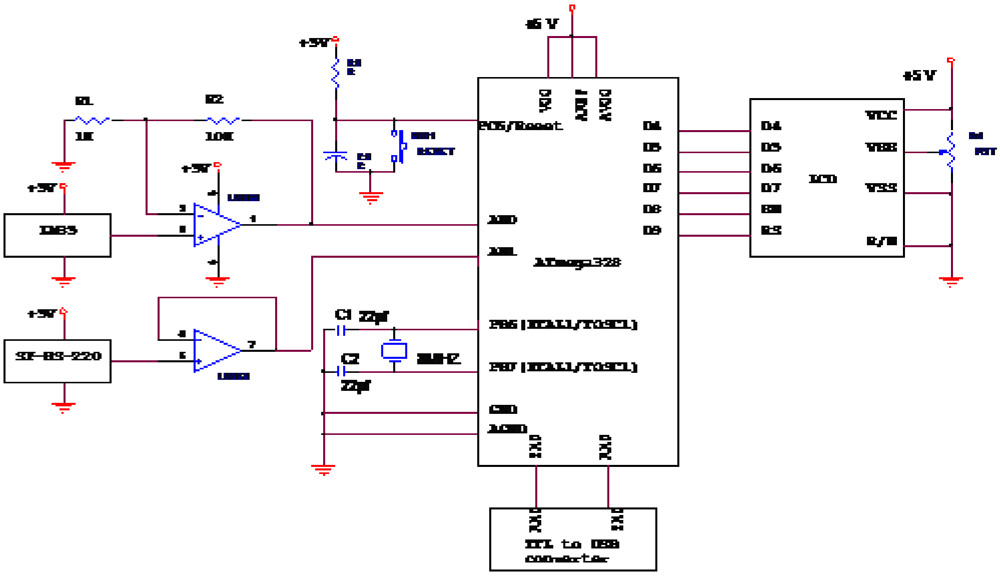

Fig. 2. Circuit diagram of the data acquisition system

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VII. Results and discussions

The measurement system is tested in a sericulture rearing environment. Data measured are updated to manylab cloud service provider at 30 sec interval. Figure 3 shows the output of measurement data in manylabs platform-as-a-service. UTC time stamp is used for timestamping of measurement data. Measurement data could be viewed by the user through Laptop, PC or mobile with internet connectivity by entering the following URL, https://www.manylabs.org/data/673/view/.

Based on the measurement results the system is found suitable for monitoring sericulture related parameters. At its present form the system with the help of manylab Platform-as-a-service provide a web-based interface for exploring the data, including graphs in time series, histograms and scatter plots. Fig 4 shows the data sets in the cloud service. Fig 5 and Fig 6 shows the histogram of temperature and relative humidity. Manylabs platform-as-a-service (Paas) also provides the user from any location can download the data from the corresponding webpage and deletion of unwanted data is also possible. Manylabs PaaS provides statistical analysis tool, sericulture farmer can able to utilize the tools without any technical programming knowledge. The cloud service provided by manylabs is easy to use and the access to the data sets is also easily understandable.

VIII. CONCLUSION

A cloud based monitoring system has been designed, built and deployed for environmental parameter monitoring in a sericulture farm. The system measures the temperature and relative humidity at regular interval of time and communicates the data to a cloud having platform-as-a-service. The system enables monitoring of environmental parameters from anywhere in the world through cloud service. The present system can be expanded to monitor the environmental parameters of multiple silkworm rearing houses by installing wireless data acquisition systems at each house and all communicating the measurement data to a centralized PC to update the data to a cloud service. The system also has the disadvantage that, the measurement data could be able to reach the cloud service only if there exists internet connectivity.

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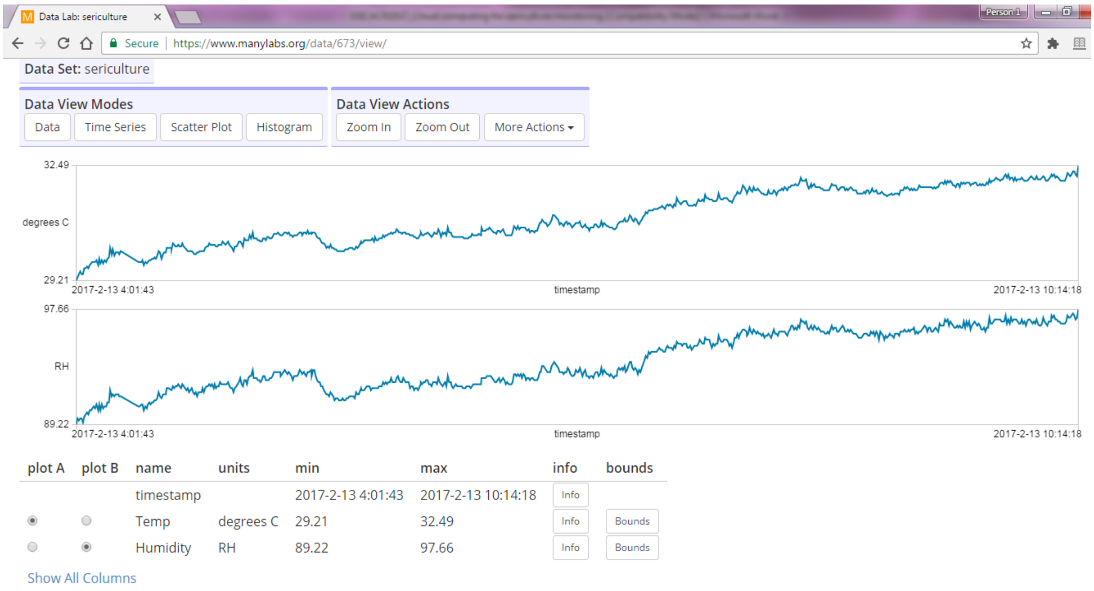

Fig. 3. Measurement data in manylabs webpage

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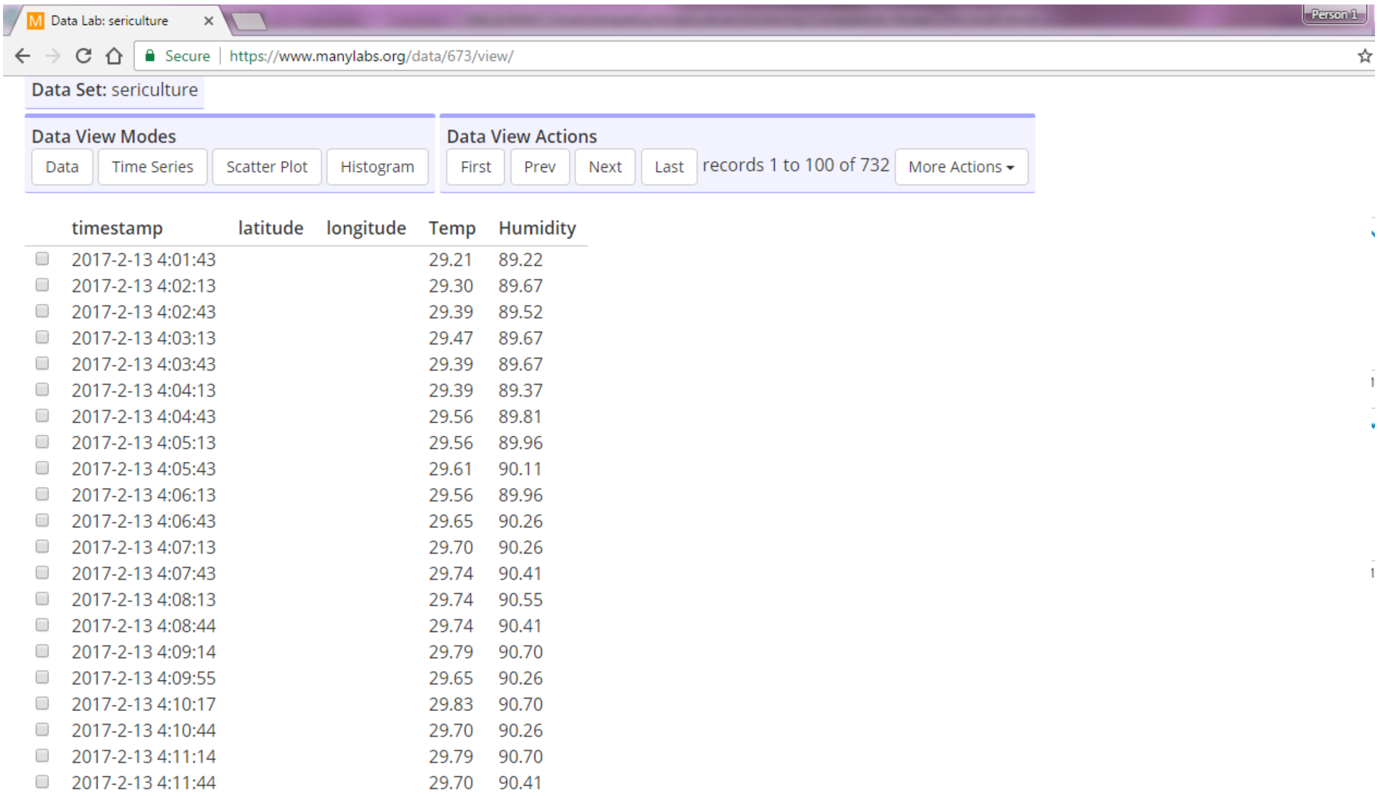

timestamp	latitude	longitude	Temp	Humidity
2017-2-13 4:01:43			29.21	89.22
2017-2-13 4:02:13			29.30	89.67
2017-2-13 4:02:43			29.39	89.52
2017-2-13 4:03:13			29.47	89.67
2017-2-13 4:03:43			29.39	89.67
2017-2-13 4:04:13			29.39	89.37
2017-2-13 4:04:43			29.56	89.81
2017-2-13 4:05:13			29.56	89.96
2017-2-13 4:05:43			29.61	90.11
2017-2-13 4:06:13			29.56	89.96
2017-2-13 4:06:43			29.65	90.26
2017-2-13 4:07:13			29.70	90.26
2017-2-13 4:07:43			29.74	90.41
2017-2-13 4:08:13			29.74	90.55
2017-2-13 4:08:44			29.74	90.41
2017-2-13 4:09:14			29.79	90.70
2017-2-13 4:09:55			29.65	90.26
2017-2-13 4:10:17			29.83	90.70
2017-2-13 4:10:44			29.70	90.26
2017-2-13 4:11:14			29.79	90.70
2017-2-13 4:11:44			29.70	90.41

Fig. 4. Data view mode in manylabs

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Fig. 5. Histogram for temperature measurement

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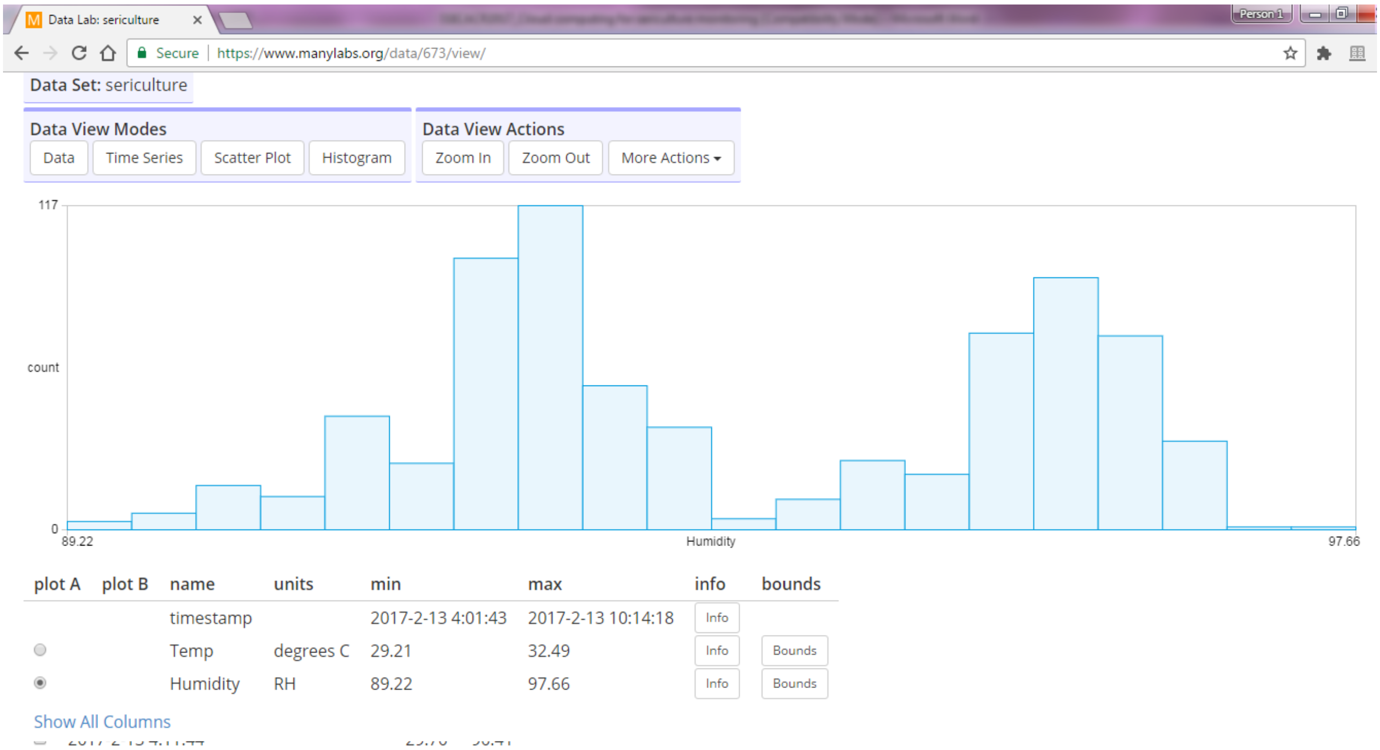

Fig. 6. Histogram for temperature measurement

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