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Frost Protection Parameters for highland crops based in IoT for Benguet Province

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Abstract

Background/Objectives: Severe atmospheric phenomenon decreases agricultural productivity. Recent years have witnessed a confusion of IoT answers helpful to varied application domain names. This paper presents an occult IoT observation post platform for good farming. This paper presents an occult IoT observation post platform for good farming. **Methods/Statistical analysis:** Specifically, the researcher tends to design a frost protection system with early warning system that collects from the deployed devices on the farmland in time period and provides frost forecasts and an early warning for the farmers using SMS based and Web-based monitoring for the weather stations. **Findings:** The planned system will effectively facilitate boost agricultural productivity by providing farmers with a lot of accurate frost forecast, thereby reducing the chance of frost harm. **Improvements/Applications:** The proposed framework is made by three parts, the data acquisition network, the climate figure service which goes about as a complementary source of data and the data processing framework. For the data acquisition network, an initial prototype has been built, deployed and tested in a real plot.

Index Terms

Frost Prediction, Internet of Things, Sensor Parameters, Microclimate, Arduino, Benguet.

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I. INTRODUCTION

In many nations around the world, severe weather conditions decrease agricultural productivity. Superior selection assists in the agricultural enterprise through IoT (Internet of Things) technology are gaining interest as it enables precision farming. Smart agriculture, based entirely on microclimate facts, enhances productivity, avoids useless harvesting costs and uses proper pesticides and fertilizers. Technically, the word "frost" refers to the formation of ice crystals on surfaces, either by physical change of condensate or a section alternate from vapour to ice (Allen, 2014). Growers frequently use the terms "frost" and "freeze" interchangeably, with the vague definition "Air temperature below or equal to 9 ° C".

The ice on the ground is called frost or frozen dew when the temperature drops below freezing and the temperature reaches the point of dew or frost. The terms frost can form either by admission or subzero. Admission frost is also known as white frost or hoar frost. It happens when the dewpoint (frost point) is under freezing. When this frost forms the water, vapor drives straight to the solid state. Admission frost shelters the vegetation, cars, etc. with ice crystal patterns (treelike branching pattern). (Barangay Annual Report, 2006)

The province of Benguet within the self-sustaining location of Cordillera represents a main rainfed upland agroecological sector committed to high-fee crop manufacturing and trade. Benguet's mountainous terrain and large dependence to seasonal rainfall make the rural stakeholders within the province especially sensitive to seasonal climatic anomalies. Recently, January 31 to February 2, 2019, Cordillera's Public Information Agency (PIA) reported frost keeps disturbing vegetables in some parts of Atok, Benguet due to the current drop in temperature. Last December, Barangay Paoay, Atok, a lowland area, started to suffer frost after the temperature began to drop. Last January 28, PIA said Baguio City noted the lowest temperature of 9.8 degrees Celsius, the temperature of Atok was projected to be 3 degrees C lower than that of Baguio City.

This work affords the improvement of a wireless sensor network (WSN), so that it will be used for frost characterization in precision agriculture by way of measuring temperature to help the farmers in Benguet especially in the towns of Atok, Kibungan, Kapangan and Bugias Benguet. One of the key goals is to ascertain the parameters and establish an architectural framework using Internet of Things in frost occurrence, allowing several dimension factors in step with node and the faraway monitoring of the sensor's behavior. Precision agriculture (PA) makes use of choice help structures to control the plants. Sensors can be used to measure the ambient parameters needed (e.g temperature, humidity). The municipal layout is specialized of meeting a neighborhood requirement parameter that are tracked in terms of frost. The damage caused by occurs while the temperature is below the tolerable plant life limit.

II. RELATED WORKS

Development of a weather station connected to the cellular network that generates alarm signal to the user if Zonda wind is detected or there is no chance of frost. The frost forecast is performed with a minimum square's estimate sequence supported disseminated temperature measurements within the field and placed in the sight's wireless sensors. The researcher also has another sensor for various meteorological variables that the user can access at any time via SMS protocol (Bardonas, et.al, 2014).

The integration of agriculture with IT can increase the productivity of it with the help of different Internet of Things (IoT) techniques. IoT could be a entity network embedded in sensors, natural philosophy, software package and network property that permits these objects to gather and exchange knowledge. Basically, IoT is divided into three layers: the sensor layer, network layer and application layer. Sensor layer is formed from totally different detectors like temperature sensor, proximity detector, and wet detector, soil wet and condensation detector (Calora, et.al, 2012).

To forecast frost more accurately, several prior studies used microclimate data such as temperatures measured at lower altitude, grass minimum temperature, diurnal, average relative humidity, minimum relative humidity, mean wind speed, etc (Crawford, 2000 & Garcia, et.al, 2011). The grass temperature is measured mistreatment thermometers simply on top of the grass, concerning 10cm on top of ground. Parameters and Hardware Components

A. Arduino AtMega 328P

The Arduino UNO is an extensively used open-supply microcontroller board based totally on the ATmega328P microcontroller and advanced with the aid of Arduino.Cc. The board is provided with sets of digital and analog input/output pins that may be interfaced with numerous boards (shields) and various circuits. The microcontroller has 14 Digital pins and 6 Analog pins. The Arduino IDE (Integrated Development Environment) can be programmed using a type B USB cable. It is used as a low powered structure, easy to get began, with extraordinary on-line aid, rapid prototyping extraordinary smooth this can send data wirelessly to

the server via personal computer or laptops.

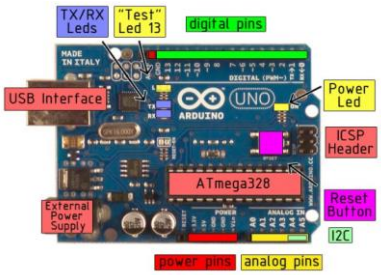

Fig. 1. Arduino Microcontroller

B. GSM/GPS WiFi Module with Shield (SIM808)

This GPRS/GSM/GPS protect in the main primarily based at the SIM808 all-in-one cell smartphone module. Can upload vicinity-tracking, voice, text content, SMS and information for your venture. SIM808 fits proper over Arduino or Maduino, it is simple to use. This protect suits proper over Arduino or well suited. It is a strong GSM cell module (we use the most recent SIM808) with enclosed GPS.

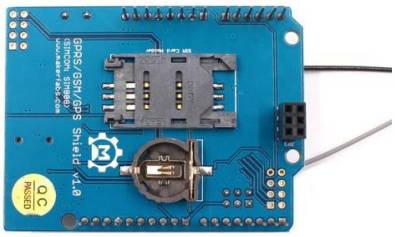

Fig. 2. GSM/GPS WiFi Module with Shield

C. Humidity Sensor (DHT11)

It ensures high reliability and excellent long term stability using exclusive digital signal acquisition technique and humidity sensing technology. This device includes a resistive wetness measurement part and connects to a superior 8-bit microcontroller with wonderful quality, fast response, anti-interference capability and cost-efficiency.

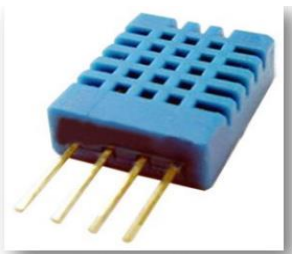

Fig. 3. Humidity Sensor

D. Temperature Sensor (LM35)

The LM35 is commonly used temperature sensor that can be used to measure temperature with an electrical o/p compared to Celsius temperature devices. LM35 will live temperature a lot of properly consider with a thermal resistor. This sensor produces a high output voltage than thermocouples and may not require and amplification of the output voltage. The LM35 has a yield energy that is relative to the Celsius temperature. The scale factor is .01V/°C.

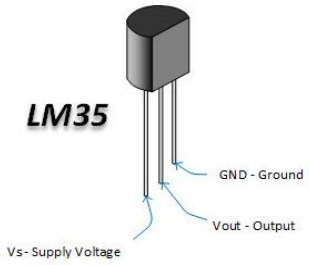

Fig. 4. Temperature Sensor

E. IoT Module

The Internet of Things (IoT) is an environment in which gadgets, animals or humans have unique identifiers and the ability to switch facts over a network without requiring the interplay between humans and computers. IoT has developed from the convergence of wi-fi technologies and the Internet. Concept may also be called the Internet of Everything.

F. Power Supply

Solar Module for Arduino is a small board capable of powering your Arduino board for a sully autonomous outdoor board. It contains a 3W solar battery that, through the module, runs 5V to your Arduino board, and a 2300 mAh Li-Ion battery. Since the project is outdoor, the solar module is the most suitable power supply for the device.

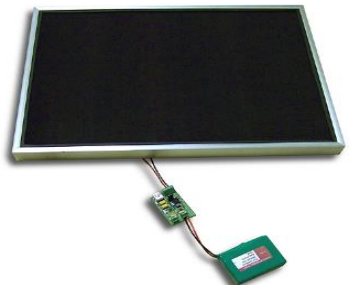

Fig. 5. Solar Panel

III. PRELIMINARY RESULTS

A. Figures and Tables

This deployed devices for monitoring frost occurrence in Benguet is based totally on measuring the humidity and temperature through sensor that

positioned at strategical locations depends on the elevation of the towns in Benguet. Multiple devices were deployed per town and it will give data on the server depends on the monitored temperature. The monitoring and controlling are performed via Internet of Things. Since the core of the system is used by the microcontroller, the set-up is low-cost and efficient, nevertheless. Since the system conjointly uses the GPS/GSM module to alert the user concerning the condition within the vegetable field endlessly, the entire setup becomes easy. When the temperature reaches its near critical level, which was set in 11°C a SMS alert will be send to the farmers that the temperature is on critical level and gradual SMS until it reaches critical level which is 9°C, the farmer can now automatically turn on the sprinkler through mobile application.

Figure 6 shows the Schematic Diagram of the prototype and the connections of the sensors in the microcontroller.

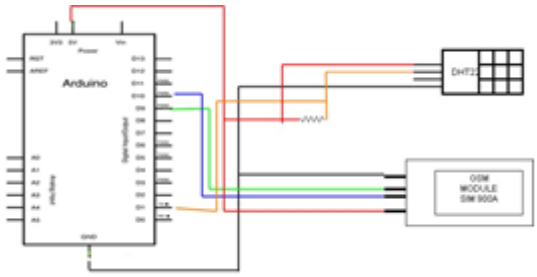

Fig. 6. Schematic Diagram

In the hardware implementation, it has wired components sensor to microcontroller connected with the sensors and the GPS/GSM module. The board is inserted with a SIM card which is used to communicate with the farmers and the server.

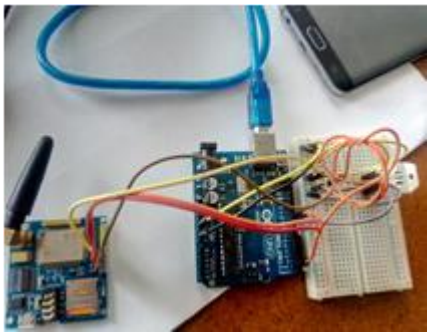

Fig. 7. Design Prototype

Thus, after the sign conditioning method the value of humidity and the temperature of the environment is transmitted through the Wi-Fi module of the proposed frost alarming system and then it's far acquired to the consumer tool via the open source IoT server. Then the real time data of the environment and vegetables including temperature, humidity sensor is transmitted. Thus, the humidity and the temperature sign are viewed with the aid of the farmer in relative to the time.

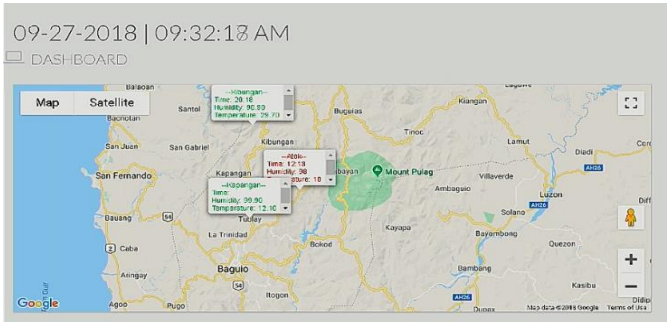

Fig. 8. Web-based Monitoring

Figure 9 shows the graphic of sensor working characteristic in this system (shown in gray) compared to ideal sensor characteristic (shown in blue), where the comparison between temperature and humidity is in normal range DHT 11 and LM35 sensors. In the gray bar, the tests are from 10°C until 12°C.

Fig. 9. Graph of the Collected Data

IV. CONCLUSION

In the paper, the researchers propose a framework in view of IoT advances to approach the crop frost issue. This issue is extremely worrying among the farmers of the Province of Benguet as agricultural protection is increasingly limited and the financial loss is winding up more detectable. There are a several techniques frameworks to battle frost, in any case, there is no financial and solid ready framework that warns or figures when there will be a frost with the goal that farmers can initiate the counter frost frameworks. The proposed framework is made by three parts, the data acquisition network, the climate figure service which goes about as a complementary source of data and the data processing framework. For the data acquisition network, an initial prototype has been built, deployed and tested in a real plot. Moreover, utilizing alternate parts of the framework an underlying statistical analysis have been developed so as to contemplate possible prototype to estimate the real temperature knowing the climate forecast. The initial result show that it is necessary to have a reliable alert system as the differences between the forecast temperature and the actual temperature are large and therefore this lack of

temperature accuracy could adversely affect the efficiency of the anti-frost systems

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To my two angels (Angel Deanne and Anjel Dhane) and to the man who completed me, Paul John D. Pacis, Thank you. Also, Thank You to the 15 wonderful people who serves as my family during my DIT days, DIT-BATCH 2.

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