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ROSES MONITORING SYSTEM VIA WIRELESS SENSOR NETWORK USING ARDUINO MICORCONTROLLER

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Abstract – **Plant monitoring is important to ensure the healthiness of the plant. The right moisture and temperature is crucial for the plant to growth. Roses is one of the plant that needs to be monitored closely, such as the healthiest of the leaves, petals of the roses, moisture of the soil and roses environment temperature. This paper implements an embedded system for rose monitoring. The proposed system consist of two main parts: hardware part and software part. The hardware is equipped with temperature sensor, soil moisture sensor, arduino microcontroller and XBee Wifi Module. XBee Wifi Module will act as an intermediate device to communicate the hardware and software. The hardware components will read the water content in the soil and surrounding temperature then wirelessly transfer the reading to interface from laptop. When the water content level is decrease to certain level the software part will alert and this information will be sent to activate the water pump relay. The proposed system manages to read the water content in the soil and environment temperature. The water pump will be activated when the water content in soil is decrease.**

Index Term – Embedded system, temperature sensor, soil moisture, Arduino microcontroller, XBee Wifi module.

I.INTRODUCTION

Every system is automated in order to face new challenges in the present day situation. Automated system have less manual operation, so that the flexibility, reliabilities are high and accurate. Hence, every field prefers automated control system. Especially in the field of electronics automated systems are doing better performance nowadays.

Design of embedded system for "Roses Monitoring System via Wireless Technology Using Arduino Microcontroller". The main idea is to implement arduino microcontroller based application which can control two type of sensors; temperature sensor and soil moisture sensor. Temperature sensor will monitoring the surrounding temperature and soil moisture will measure the water content in soil. This project will be develop using Arduino Nano as the main board.

As the term wireless, XBee Wifi module will be used in this project to interact hardware component and GUI interface. The GUI interface will be develop using Microsoft Visual Basic 2010 and Microsoft Excel as the database for the system. The current system used made them unable to monitor the exact condition of the roses, such as the condition of soil moisture and environment temperature. Other than that, there are no wireless monitoring system that can monitor the condition of the roses. As a solution, the GUI interface will be used in this project to monitor the roses wirelessly. Firstly, the Arduino Microcontroller will catch the data from temperature and soil moisture sensor, then the exact reading will appears on LCD screen. After that, Arduino will sent the data to XBee and XBee will sent the data to GUI interface. From there the GUI interface will receive the data to view the exact reading from the laptop. From the GUI interface the user can control water pump operation, the user can set it manual and auto operation. For the auto operation the user need to set the maximum reading for example the normal temperature is 30° Celcius and the maximum is 35° Celcius. If the temperature get more than 35° Celcius the pump washer will automatically pump the water. The main purpose of this project is to catch the reading from temperature and soil moisture sensor, send the data to GUI interface and then storing the reading into the database.
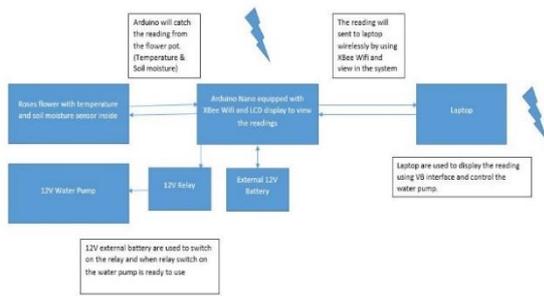
II. SYSTEM DESCRIPTION

Fig. 1. Roses Monitoring System via Wireless Technology Using Arduino Microcontroller

Figure 1 shows the overall block diagram of Roses Monitoring System. The Arduino Microcontroller will catch the data from temperature and soil moisture sensor, then the exact reading will appears on LCD screen. After that, Arduino will sent the data to XBee and XBee will sent the data to GUI interface. From there the GUI interface will receive the data to view the exact reading from the laptop. From the GUI interface the user can control water pump operation, the user can set it manual and auto operation. For the auto operation the user need to set the maximum reading for example the normal temperature is 30 Celcius and the maximum is 35 Celcius. If the temperature get more than 35 Celcius the pump washer will automatically pump the water.

Fig. 2. Main component on board

Fig. 3. Temperature Sensor DS18B20

Fig. 4. Soil Moisture Sensor

Fig. 5. Water tank with water pump

III. RESEARCH METHODOLOGY

The development of "Roses Monitoring System via Wireless Technology Using Arduino Microcontroller" were consist of two important fractions which the hardware development and software development. Methodology to be implemented in this project consists of six stages as shown in figure 6.
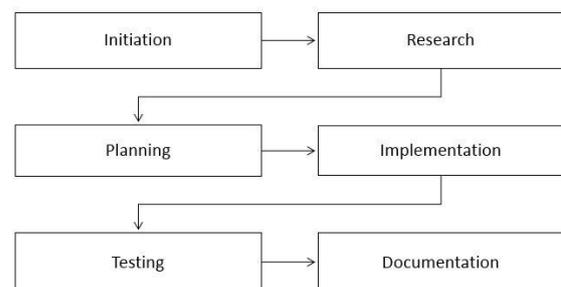

Fig. 6. Project Life Cycle

a. Literature Review

This section provides an overview of some earlier Roses Monitoring System and all components that might be used in the development. In the end, a brief discussion in terms of advantages and disadvantages of each method are describe.

b. Hardware Development

Hardware is a physical components that have been merged together in order to build and form a "Roses Monitoring System via Wireless Technology Using Arduino Microcontroller.

1)Arduino Nano (main board)

In this project, Arduino Nano are the main device in this project. The Arduino Nano is a small, complete, and breadboard – friendly board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lack only DC power jack, and works with a Mini – B USB cable instead of a standard one. The Nano was designed and is being produced by Gravitech.

Temperature Sensor DS18B20

This sealed digital temperature probe lets you precisely measure temperatures in wet environments with a simple 1 – wire interface. The DS18B20 provides 9 to 12 – bit (configurable) temperature readings over a 1 – wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor.

Soil Moisture Sensor

This sensor comes in 2 parts, sensor probes and module board. The sensor is basically two probes to be inserted into soil. This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance)

XBee Wifi Module

XBee Wifi module provide simple serial to IEEE 802.11 connectivity.by bridging the power – power / lower – cost requirements of wireless device networking with the proven infrastructure of 802.11, the XBee Wifi creates new wireless opportunities for energy management, process and factory automation wireless sensor networks, intelligent asset management and more.

LCD 16X2 Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of application. A 16 X 2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LEDs. The reason being LCD are economical, easily programmable, have no limitation of displaying special and even custom characters (unlike in seven segments) animation and so on

Software Development

Software is one of the most important part of implementing a system or device to interfere with hardware in order to ensure the functionality of the system.

Microsoft Visual Basic 2010

Visual basic is a third – generation event – driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model first release in 1991. Visual basic was derived from BASIC and enables rapid application development (RAD) of graphical user interface (GUI) application, access to database using Data Access Object, Remote Data Objects, and creation of ActiveX control and objects. The Visual Basic program will interacts with two hardware of the system which is Arduino Nano and XBee Wifi module. The Visual Basic program will receive the data send by XBee and display the data in interface. The Visual Basic interface will display the actual temperature reading and soil moisture reading. At the same time, the details of temperature and soil moisture can store in the database. Furthermore, the Visual Basic program acts as controller to control relay to switch on the water pump.

Arduino Software Compiler

The open – source Arduino environment makes it easy to write code and upload to the I/O board. It runs on Windows, Mac OS X, and Linux. The environment is written in java and based on processing, avr – gcc, and other open source software.
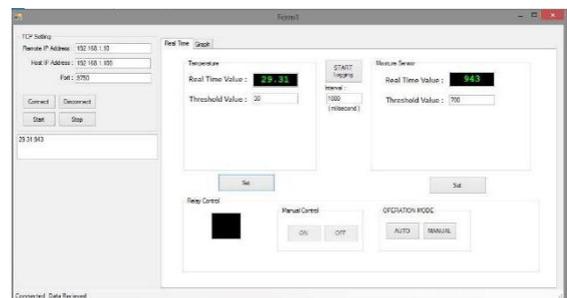
IV. TESTING

    A.   Interface Testing

Fig. 7. Visual Basic Main Interface

Figure 7 above shows the main interface for Roses Monitoring System via Wireless Technology Using Arduino Microcontroller by using Visual Basic. On the top left group box name "TCP Setting" consist of Remote IP Address for XBee Wifi and Host IP Address for laptop. Below text box consist four button which is "Connect" for connect XBee wifi to laptop, "Disconnect" for disconnect the connection, "Start" for start receiving the data and "Stop" for stop receiving the data. On the right consist of tab control, inside it consist temperature and soil moisture real time value. Middle between group boxes consist of button "START Logging" for log the data and save in database. Below right consist of group box name "Relay Control", inside this box consist two group box which is "Manual Control" and "Operation Mode".
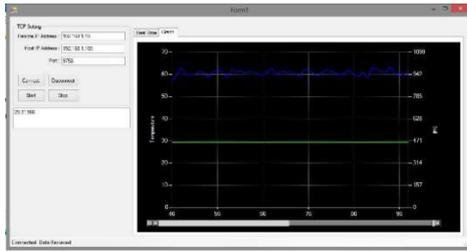
Fig. 8. Line Graph

Figure 8 above show the line graph inside the interface. Line graph is a type of chart which displays information as a series of data points called "markers" connected by the straight line segments. From the figure above the "green line" indicate the temperature reading and the "blue line" indicate the soil moisture reading.
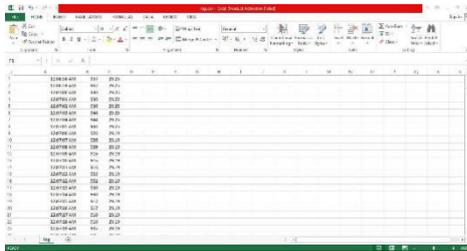

Fig. 9. Database

Figure 9 above show the saved database file name "log.csv". Inside the database consist the reading of temperature, soil moisture and time.

A. Data Analysis

1. Data analysis from lower ground (Condominium Sentul Utama)

Table 1. Data Analysis from lower ground

time	Soil moisture	temperatur
12:06:56 AM	100	29.25
12:06:59 AM	99	29.25
12:07:00 AM	86	29.25
12:07:01 AM	79	29.25
12:07:02 AM	75	29.25
12:07:03 AM	70	29.25
12:07:04 AM	60	29.25
12:07:05 AM	63	29.25
12:07:06 AM	63	29.19
12:07:07 AM	65	29.19
12:07:08 AM	69	29.19
12:07:09 AM	70	29.19
12:07:10 AM	76	29.19
12:07:11 AM	76	29.19

12:07:12 AM	79	29.19
12:07:12 AM	81	29.19
12:07:13 AM	99	29.19
12:07:14 AM	100	29.19
12:07:15 AM	150	29.19

Table 1 show the data analysis from the lower ground at Condominium Sentul Utama. According to the result, the environment temperature are little bit hot and fixed. For the soil moisture the result not to be in fixed range because it was affected to the temperature of surrounding area and the type of soil. But in the end, by using the "Roses Monitoring System via Wireless Technology Using Arduino Microcontroller" the roses are able to adapt in such situation. The percentage for the rose plant to damage is decrease.

1. Data analysis from higher ground (Fraser Hill)

Table 2. Data analysis from higher ground

Time	Soil Moisture	Temperature
11:06:56 AM	320	28.94
11:07:59 AM	320	28.85
11:08:00 AM	320	28.77
11:09:01 AM	320	28.5
11:07:02 AM	322	28.4
11:08:03 AM	325	27.75
11:09:03 AM	325	27.7
11:10:03 AM	327	27.59
11:11:03 AM	325	27.55
11:12:03 AM	326	27.55
11:13:03 AM	329	27.5
11:14:03 AM	329	27.48
11:15:03 AM	330	27.48
11:16:03 AM	331	27.47
11:17:03 AM	331	27.45
11:18:03 AM	335	27.44
11:19:03 AM	335	27.44
11:20:03 AM	337	27.43
11:21:03 AM	336	27.42
11:22:03 AM	335	27.4
11:23:03 AM	336	27.36
11:24:03 AM	336	27.36
11:25:03 AM	337	27.35
11:26:03 AM	338	27.34

11:27:03 AM	338	27.32
11:28:03 AM	348	27.31
11:29:03 AM	348	27.29
11:30:03 AM	349	27.26
11:31:03 AM	350	27.24

Table 2 show the data analysis from the higher ground at Fraser Hill. According to the result, the environment temperature are different from the lower ground. Beside that the soil moisture range are in constant reading because of the environment temperature are little bit cooled and moist. In the end the rose plant are perfectly healthy and able to adapt to any diseases.

V.CONCLUSION

In conclusion, Roses Monitoring System via Wireless Technology Using Arduino Microcontroller has been successfully develop and the objectives and requirements of this project have been achieved. This project was develop to monitor the condition of the roses wirelessly by using XBee Wifi module. The user can monitor the condition of roses from GUI interface develop by using Visual Basic 2010. Furthermore it will helps florist and gardener to get right and systematic reading to ensure that they can make early preparation for the roses. Unlike the traditional method where florist and gardener have to make their own estimation on the rose's conditions based on their experience and need to move to check each of the roses. The conversion from the traditional method to this project will help to reduce time and cost on the rose condition and workers preparation. From the result from the analysis has been made to find the proper or suitable condition to plant the roses and to maintain the healthiness of the plant. Furthermore, by using this system the changes of Roses condition can be detected and the future action can be taken quickly to ensure the growth of the Roses flower. In the future this system will help the florist and gardener involve themselves into the technology of monitoring system. In conclusion the Roses Monitoring System via Wireless Technology Using Arduino Microcontroller has been successfully developed and the objective and requirement of this project have been achieve. This project was developed to ensure that the user are able to get the reading from laptop and control the water pump operation wirelessly.

ACKNOWLEDGEMENT

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