IOT BASED INDOOR GARDEN MONITORING SYSTEM

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Abstract: IoT allows objects to be sensed and controlled remotely across existing network infrastructure , creating opportunities for more direct integration between the physical world and computer – based systems , and resulting in improved efficiency , accuracy and economic benefit. As water supplies become scarce and polluted, there is an urgent need to irrigate more efficiently in order to optimize water use to support green environment. This project explains a smart Houseplant Watering and Monitoring system that monitors and tracks environmental conditions, helping the plants thrive. The sensors gather and analyze data about changing weather and soil moisture conditions and then connects to the user's Android phone with timely alerts.

Keywords: Internet of Things, Indoor garden, Soil moisture sensor.

I.INTRODUCTION

The vast network of devices connected to the Internet, including smart phones and tablets and almost anything with a sensor on it – cars, machines in production plants, jet engines, oil drills, wearable devices, and more. The Internet of Things (IoT) is creating a flood of new technology. As a result, the automation industry is fortunate to have an expanding range of technologies available to solve problems, improve operations, and increase productivity.

The first impact of IoT technology in the automation industry is the use of tablet computers, smart phones, virtualized systems, and cloud storage of historian data. In this paper, the sensors measure the moisture in the soil and the temperature, and automatically controls the water flow to the garden. People often grow unsuitable plants in their gardens so that they usually die from the lack of enough water, or even too much sunlight. In this paper we use the sensors to obtain the values of the parameters and process them using arduino microcontroller and control the survival of plants in the garden. Based on the soil type and plant type, the water requirement for the plant is defined. The user is also alerted periodically about the plants' conditions.

II. INTERNET OF THINGS

The Internet of Things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items-embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The IOT allows object to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Development of RFID tags, sensors, actuators, mobile phones make it possible to materialize IoT which interact and co-operate each other to make the service better and accessible anytime, from anywhere. It links the objects of the real world with the virtual world, thus enabling anytime connectivity for anything at any place.

III.RELATED WORKS

The existing system is based on the soil moisture sensor alone. Based on the output of the soil moisture sensor, the user is intimated with the help of different LED lights.

There are two categories in the existing system :

i. Single-point sensing
ii. Multi-point sensing

Single-point of sensing requires Wi-Fi access on all nodes. It is not capable of representing the status of the whole garden. Multi-point of sensing builds its own ZigBee network instead of totally relying on existing Wi-Fi network. Nodes are sensor set boxes placed in the garden, and are responsible for uploading all sensor values to the self-built ZigBee network.

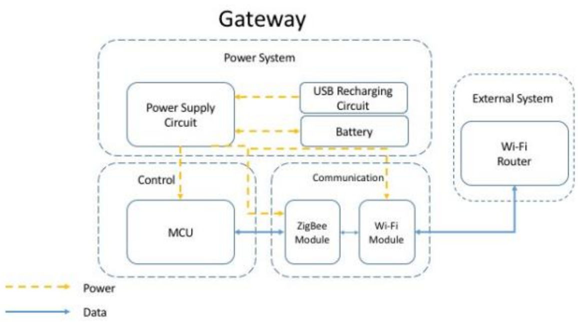

Figure 1: Block diagram of existing system

Gateway is a box containing only communication modules.

IV. SYSTEM DESCRIPTION

The proposed system consists of sensor motes , soil moisture sensor , sensor driven motor that controls the water flow to the garden and an android application that is used to interact with the user. The soil moisture is kept in the plant and the moisture content is measured constantly and the temperature sensor obtains the temperature of the surrounding environment and the gathered values are verified for the threshold values fixed for the survival and growth of the plants.

The plant's moisture is monitored continuously. When the value drops below the fixed value, an alert is forwarded to the user through the mobile application. The motor is automatically operated and water flows to the plant. When the water level drops below the minimum limit in the tank , an alert is forwarded to the user through the application.

Apart from the moisture of the soil , the temperature of the surrounding environment is also intimated to the user through the android application.

A. HARDWARE DESCRIPTION

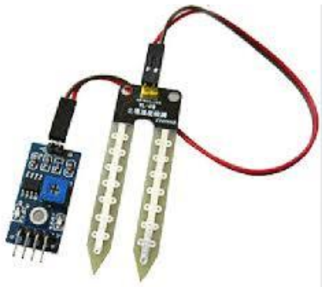

Figure 2: Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing , drying , and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some property of the soil.

The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature , or electric conductivity.

Figure 3: Temperature Sensor Lm35

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy). The LM35-series devices are available packaged in hermetic TO transistor packages, while the LM35C, LM35CA, and LM35D devices are available in the plastic TO-92 transistor package. The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package.

Figure 4: Arduino UNO

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

B. SOFTWARE DESCRIPTION

The Arduino IDE is a cross-platform Java application that serves as a code editor and compiler and is also capable of transferring firmware serially to the board. The development environment is based on Processing , an IDE designed to introduce programming to artists unfamiliar with software development. The programming language is derived from Wiring, a C-like language that provides similar functionality for a more tightly restricted board design , whose IDE is also based on Processing.

The open-source Arduino software (IDE) makes it easy to write code and upload it to the board. It runs on the windows , Mac OS X , and Linux. The environment is written in Java and based on processing and other open-source software. This software can be used with any Arduino board.

Android Studio is the official integrated development environment (IDE) for the Android platform. Based on JetBrains' IntelliJ IDEA software, Android Studio is designed specifically for Android development. It is available for download on Windows, macOS and Linux, and replaced Eclipse Android Development Tools (ADT) as Google's primary IDE for native Android application development.

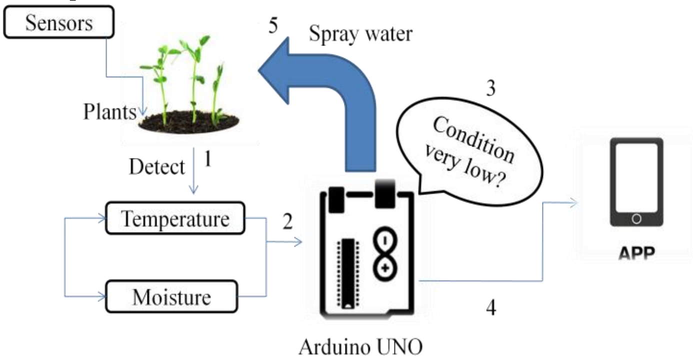

Figure 5: Block diagram

V.EXPERIMENTAL RESULTS

The results of the experiment in monitoring the plants' parameters are discussed below. This proposed project includes Integrated temperature sensor and moisture sensor, notification to the user via android application. The microcontroller can be coded to water the plants in the greenhouse about two times per day. Reports status of its current conditions and also reminds the user to refill the water tank by mobile application.

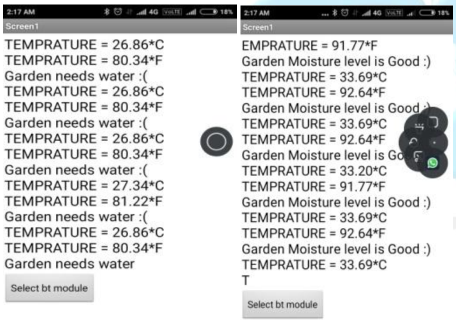

Figure 6: Screenshots of the mobile application

VI.SUMMARY

This paper discusses the various applications of temperature sensors and their implementation in our project. Many consumers use digital thermometers every day and due to their usefulness they have become cheap and readily available. In our project, temperature sensors are used to detect the ambient temperature. Precision Fahrenheit Temperature Sensor LM35, created by National Semiconductor, with the PIC18F4520 microprocessor provided by Microchip, is used to implement this device. Physical connection between the two devices can be accomplished using a simple breadboard. Different setup of hardware and software implementation will be discussed, which is required by the system to read the desired temperatures.

VI.CONCLUSION

The project deals with the automated temperature and humidity control. The proposed hardware configuration allows for a relatively simple and cheap method for automation of indoor garden monitoring. The results show that the proposed system has good feasibility. It reduces the cost of monitoring system at the same time.

The future enhancements in this project are plant type and soil type can be used to suggest the user about the fertilizers , water level for each type. An additional feature of monthly growth analysis can be added. The user can be provided a prior alert about the level of water tank.

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