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IOT BASED COOPERATIVE AGENTS ARCHITECTURE

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ABSTRACT:

After briefly discussing the Internet of Things and Cyber physical device main features, their application in a specific architecture for a simple distributed intelligent system was presented. The system works as a Multi agent system and it is based on Arduino Uno boards, each one hosting an intelligent agent. The system was developed as test equipment for an active intelligent water meter for a SMART CITY project. The proposed system can be generalized and usable also with very simple (and therefore economical) computational units and allows to delocalize in similar units the computational load exceeding the single node capability; a specific data protocol, based on I 2C, is used to share the knowledge between agents.

Keywords: Smart city, data protocol, chip, IOT applications.

1. INTRODUCTION

The demand of service over the internet necessitated the data collection and exchange in an efficient manner. Internet of Things refers to the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. It is nowadays finding profound use in each and every sector and plays a key role in the proposed environmental monitoring system too. IoT converging with cloud computing offers a novel technique for better management of data coming from different sensors, collected and transmitted by low power, low cost microcontroller "Arduino UNO". An open source website, Thingspeak is used where the measurement of the parameters are updated. Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using the HTTP Protocol over the Internet. Thingspeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. The cloud utilizes the operations of Graphical visualization and available in the form of virtual server for the users and the objects are communicated with the cloud via possible 'wireless internet connections' available to the users and the majority objects uses the sensors to tell regarding the environmental analogue data. The IoT helps bring all things together and permits us to communicate with our very own things. The measurements thus received can be viewed in these scripts such as JSON, XML and CSV. In the proposed system, the environmental parameters can directly be accessed by the user, thus eliminating the need for third parties.

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2. LITERATURE SURVEY

Recently climatic change and environmental monitoring and management have received much attention. The paper introduces three different IoT based wireless sensors for environmental and ambient monitoring: one employing User Datagram Protocol (UDP)-based Wi-Fi communication, one communicating through Wi-Fi and Hypertext Transfer Protocol(HTTP) and third one using Bluetooth Smart. The above presented systems help in recording data at remote locations and viewing it from every device with an Internet connection. Here Zigbee is used to monitor and control application where wireless connectivity is required. UDP based cyber physical system monitors the temperature and relative humidity. Here the losses are caused by the network itself. The WiFi sends the UDP or HTTP packets to a Cloud Platform which makes it available only to the administrator who decides whether the data must be public or private. BLE consist of sensors placed at various areas at which they produce a beacon when data is received and the server takes the information from the sensors whenever the beacon is produced. The available Environmental Monitoring System (EMS) uses UDP protocol which requires the establishment of connection and IP matching every time. Direct access of the geographical information is not available since the information is sent to a centralized platform and admin plays a major role.

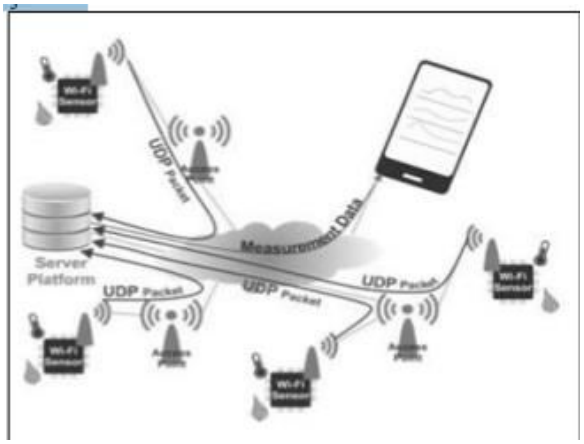

Fig.2.1. Proposed model.

3. RELATED STUDY

Today, the large number of devices equipped with sensors and connected to the network produces an enormous amount of data. These data are characterized by elevated heterogeneity, aperiodicity and, generally, expressed without reference ontology or at least one semantics/synthesis evident. Certainly, expressions in rich and structured formats such as XML and similar one are often replaced by lighter forms but poor in information, JSON (JavaScript Object Notation). It is easy for humans to read and write but not explicit. It is easy for machines to parse and generate and it is based on a subset of the JavaScript Programming Language. The relevant amount of collected data may be difficult to use, or even unnecessary without further processing that could turn it into usable and contextualized information. As a result, in recent years there has been a change in research trends, which have focused towards the fusion of engineering with IoT technologies. In this context, ambient

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intelligence and autonomous control experienced a growing attention. By mediating the high computational capacity of the current single board computers (SBC) used in IoT infrastructures and the extreme granularity reachable, it is evident the use of approaches such as intelligent agents, or, for example, hardware and software combinations that can be used to enable autonomous and intelligent systems. In fact, agents can represent any entity, perform a wide variety of human-like tasks such as learning, reasoning, negotiation, self-organization and mutual trust. Considering the free-fall cost of hardware, along with the rise of easy-to-use programming frameworks, these applications are wide-spreading. The aim of this paper is to present a distributed and intelligent architecture, compatible with Arduino (open source platform) or similar SBC that is scalable and modular according to the desired application. Constraints in the architecture definition were a low computational load and a reduced data transfer between nodes. At the same time, each agent is aware of his or her surroundings and can pursue both local (owners) and global goals. The test bed, developed at the Polytechnic of Bari in cooperation with my Hermes company, for a Smart-city project financed by the Ministry of Research and Education, is presented. The system is aimed at the creation of a calibration and control system for electronic water meters. In details the tested here presented is aimed at evaluating an intelligent anti-freezing system, based on a multivalent architecture where a fuzzy controller unit is present as decision support.

4. PROPOSED SYSTEM

The proposed system keeps track on the parameters such as moisture, temperature, humidity, rainfall, gas content and earthquake intimation with the help of the real time sensors. These parameters are continuously monitored by an open source platform called Thingspeak for an interval of every 2 minutes. The data can be viewed in any one of the three formats such as JSON, XML and CSV. The sensors in the proposed system collect the data such as the temperature, humidity, soil moisture, pollution level, rain water level and movement in the earth surface. The Wi-Fi network helps in the process of sending the collected data to the open source platform, Thingspeak. Alternate to that, an app is made for the purpose of viewing the collected data in even more easier manner. Through the application/Thingspeak, the user will be able to know about the status of his/her own agricultural land and counter-measures can be taken after the keen observation of the parameters of the land.

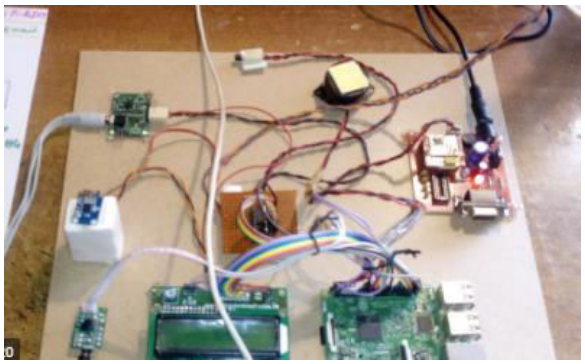

Fig.4.1. Hardware kit image.

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The main role of updating data continuously is done by Thingspeak, which has APIs for collecting data produced by sensors and APIs for reading that data from applications. The paper is divided into two parts. One part of the paper is where one has to program a thing to send data. And, the second part is where the other has to see the data. Thingspeak sits in the middle and makes it handy to do both. The paper uses easily accessible hardware to build a proof-of-concept IoT system to monitor air temperature, humidity, soil moisture, soil humidity etc. Further this can be modified with different sensors or actuators for building something for individual purposes. Thus a direct access to all the environmental parameters is given to the user after the above stated procedure is completed.

Fig.4.2. OUTPUT in thingspeak.

5. CONCLUSION

The paper presents an architectural scheme and a protocol for implementing a network of SBCs hosting cooperating intelligent agents [40]. In this specific case, the system, based on 10 SBCs of the Arduino-Uno type, has been used to control a test system for electronic water meters carried out as part of a SMART CITY project. The system is scalable and modular and can integrate both agents equipped with sensors and/or actuators, but also computational units always based on simple and low-cost boards able to communicate via I2C bus. The possibility of sharing goals among agents makes both local and global optimizations possible and simplifies both the external communication of global states (test results but also errors and anomalies), but also from outside the system by redefining global objectives. Local objectives can also be modified externally or seen as local functions that are included in the definition of global objectives.

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