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Carp Fish Cultivation Pond Monitoring System using Arduino

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Abstract: With 168 million inhabitants, Bangladesh is a country with a high population density. The abundance of rivers, ponds, lakes, canals, beels, hares, and estuaries that serve as water sources is a blessing. The production of crap fish has greatly expanded over the past few decades, satisfying the lower middle class and middle-class requirement for protein. By creating the ideal conditions for its growth, we may boost its cultivation and make it more accessible to all societal levels. To establish this ideal environment, we develop a monitoring system employing a temperature sensor to help maintain the water's temperature between 25- 30, an ultrasonic sensor to determine the water level, and a turbidity sensor to notify the farmers of the water's cleanliness. It also saves the readings of the sensor to the cloud for later use and observation.

1 Introduction

Bangladeshi people have been given the title of "Machhe Bhaate Bangali ". From this simple tagline, we can comprehend what place fish have in the hearts of the people of Bangladesh. In the past few years, the need to provide the growing population with enough animal protein to overcome the global challenges of hunger, malnutrition, and health-related issues has been the major focal point. Fish plays an important role here. It is one of our staple foods that is the most popular animal protein source in our country. Out of all the other fish cultivated in Bangladesh Carp fish makes up 33.49% of total fish production which is the maximum of all other fish cultivated. Despite this, thirty-four percent of farmers reported that their production declined because of water quality[2]. An optimum environment can increase the production of carp fish greatly. We discuss a monitoring system that will help the farmers to maintain this optimum condition so that a satisfying portion of production can be achieved.

This paper tests a monitoring system that includes a DS18B20 sensor that can measure water temperature, an HC-SR04 sensor that determines water level, a turbidity sensor to assess the water's cleanliness, and ESP8266 ESP-01 Al Cloud Inside to connect to the wifi to save the data in the cloud. .

The paper is prepared as follows: section 2 describes the literature work, section 3 talks about the methodology that includes system architecture in 3.1, technical specifications in 3.2, and design and implementation in 3.3. Section 4 describes the user feedback and future goals. We conclude in section 5 and add the references at the end of the paper.

2 Literature Review

The actions associated with embedded systems that use IoT for fish cultivation are covered in this section by numerous project proposals. From the research work mentioned we gathered knowledge and tried to imply all the measures taken on those projects in the Bangladesh context. As in Bangladesh, carp fish cultivation is maximum so we grabbed the opportunity to increase the production of carp fish by automatizing the fish monitoring system to minimize the laborer's workload.

The similar concept projects that were done earlier somewhat resemble our work. Z. Harun, E. Reda, and H. Hashim wrote a paper regarding fish pond monitoring in which they measured the temperature of the water and atmospheric temperature using a temperature sensor, DO sensor to determine the dissolved oxygen in the water and pH sensor to measure the acidity and alkalinity [1].

The paper by Francis E. Idachaba, Joseph O. Olowoleni, Augustus E. Ibhaze, and Oluyinka O. Oni also has some advanced features. They also kept the temperature sensor and pH sensor for similar purposes. Their project is IoT based, they regularly monitor the level of water using level sensors, electronic tapes to start and stop the discharge of water, and automatic feeding of the fish. The pond controller monitors all the sensors and is also integrated with GSM to connect with the pond manager in the mobile. They also used a CCTV camera to monitor all changes and store the data in the cloud which are easily operable by mobile phone to reduce the cost associated to manage the system [2].

The paper by Nahla Abdul Jalil Salih, Ihsan Jabbar Hasan, and Nadhir Ibrahim Abdulkhaleq regarding smart monitoring systems has the application included 2 sensors which are a temperature sensor and a pH sensor. A smart application was also developed for cloud monitoring fish farms [3].

The paper by Anggara Trisna Nugraha, Dadang Priyambodo about catfish cultivation has a particular focus on cultivating catfish because it contains a higher proportion of protein than in milk and beef which is relatively costly. To provide the optimum environment for the fish they monitored the pH of the pond, and temperature, used a flow meter to regulate the water flow, and an LDR sensor to detect turbidity level [4].

In the paper by A B M Mohsin, MN Islam, MA Hossain, and SM Galib which talks about the prospects of Carp production broadly discussed the problems in cultivating carp fish and prospects of how by high-quality feeding and standard dose fertilizing, they can see a rise in the crap fish production and hence they can earn their desirable profits [5].

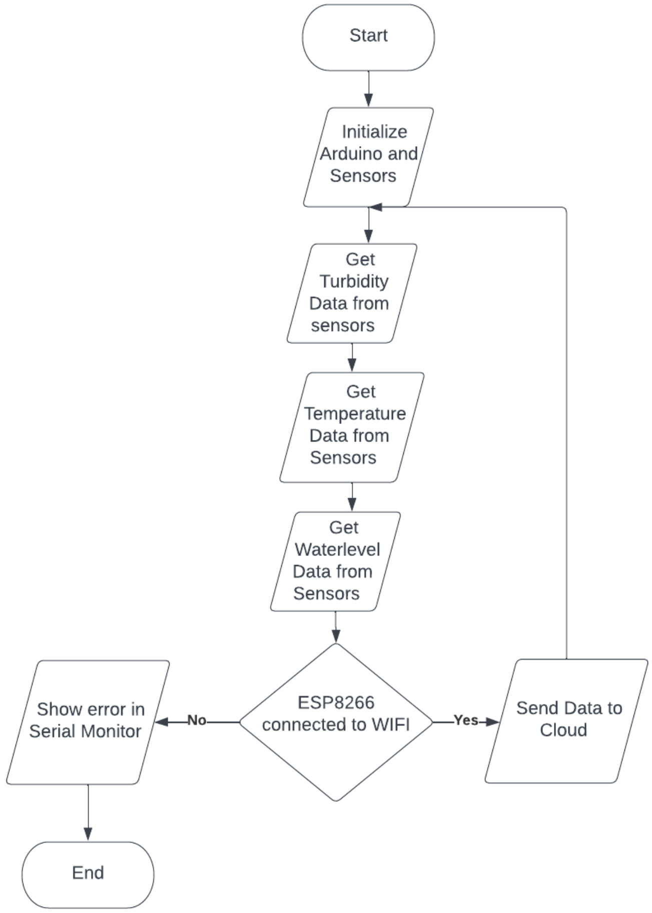
The paper by Khairun Nisa Hairol, Ramli Adnan, Abd Manan Samad, and Fazlina Ahmat Ruslan also has an objective to monitor temperature, water level, automatic fish feeding, and water changing at particular intervals of time. They used an app named Blynk application that will show all the features implanted in the form of a graph [6].

In a similar fashion a paper by Md. Monirul Islam, Mohammad Abul Kashem, and Jia Uddin monitor five different pond water and measure their pH, turbidity, and temperature to find the best suitable pond among those using Arduino and sensors for real-time monitoring of the water environment [7].

Also in the paper by Agritian Sevty Fiddariani, Unan Yusmaniar Oktiawati based on fish pond monitoring monitors the pH and temperature and transfers the data to the cloud to design the system [8].

3 Methodology

3.1 System Architecture



For this project, 3 sensors are used for demonstration purposes. They are a temperature sensor, turbidity sensor, and ultrasonic sonic sound sensor. The ultrasonic sound sensor is used to calculate the water level [19]. Now for the system working principle, when the Arduino starts it will initialize the Arduino sensors and also connect to the wifi using the wifi module i.e ESP8266-ESP01. After the initial setup is done, the setup will fall into a continuous loop. Firstly, it will request the turbidity data, then the temperature data, and finally the water level data. Now if the Arduino is connected to WIFI it will send data to the cloud and again will request data from the turbidity sensor and continue to follow the loop. Again if the Arduino is not connected to the internet, then it will show an error in the serial monitor.

For the storage of cloud information, ThingSpeak is used. ThingSpeak is a live IoT cloud storage platform that is used to visualize data and analyze it. Because of its simplistic design and user interface, this platform is chosen.

3.2 Technical Specifications

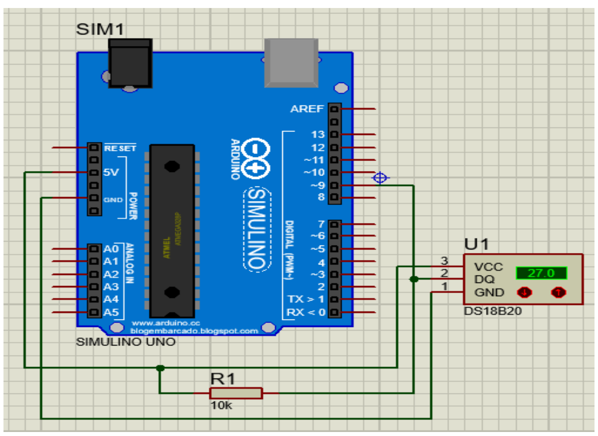
SL.	Component Name	Manufacturer Name	Use
1	DS18B20 Waterproof Digital temperature sensor	Dallas Semiconductor SEN-31820	To measure temperature of the water
2	HC-SR04 Ultrasonic Sonar Sensor	Not mentioned SEN-10004	To measure water level
3	Turbidity Sensor Module Mixed Water Detection	Not mentioned SEN-33051	To measure turbidity of the water
4	DC5V to 3.3V Power Supply Module (Buck)	Not mentioned MOD-10805	To convert 5V to 3.3V
5	Arduino UNO R3	Not mentioned ARD-50328	Primary microcontroller
6	ESP8266 ESP-01 Al Cloud Inside	Not mentioned WIFI-28266	To connect microcontroller to WIFI
7	Jumper wires Male - Male Male - Female Female - Female	Not mentioned	To connect sensors
8	Breadboard		
9	Resistors 10Kohm 1Kohm		

Now since the project is mainly focused on pond monitoring, 3 sensors are primarily used which are a DS18B20 temperature sensor, turbidity sensor, and ultrasonic sound sensor. The temperature sensor is used to measure the temperature of the water, turbidity is used to measure the turbidity of the water and an ultrasonic sensor is used to measure the water level. For the microcontroller, two microcontrollers are used which are Arduino UNO R3 and ESP8266-ESP01. The Arduino board is the primary microcontroller. The ESP board is connected to the Arduino board using serial communication and is used as a wifi module to connect to the internet.

3.3 Design and Implementation

Three main sensors are used to connect to the Arduino board. They are the temperature sensor, ultrasonic sound sensor, and turbidity sensor. A demonstration of the connection of individual sensors is shown in fig 1, 2 and 3. In fig 4, the actual circuit is shown connected to Arduino Uno and with ESP8266-ESP01 as a wifi module.

Fig:1 shows the connection of the temperature sensor. A temperature sensor has pins which are VCC, ground and data. The VCC is connected to 5V connections while ground is connected to ground of the arduino board. The temperature sensor requires a 10k resistor for it to work effectively. For this a 10k resistor is added between VCC and data pin.
Fig: 2 shows the connection of the HC-SR024 sensor. The HC-SR024 sensor has 4 pins which are VCC, ground, echo and trigger. The VCC is connected to the 5V pin of the arduino while the ground is connected to the ground. The echo pin and trigger pin is connected to the digital pins.
Fig: 3 shows the connection between the turbidity module and Arduino board. The turbidity sensor requires a module to work correctly. The module is connected has 3 pins which are VCC, ground and data. It is also connected to the 5V pin of the arduino. The turbidity sensor is an analogue sensor sensor which is why the data pin is connected to the analogue pin of the board.
Additionally an ESP8266-ESP01 is used as wifi module. The module requires 3.3V connection. However, the 3.3 volt connection present in the arduino board is not enough for the ESP board. For which a voltage regulator is used to convert the 5V to 3.3V.
Fig: 4 shows the final connection of the circuit. With the all the materials required the total cost of the project was 3100TK.



.Fig 1: Connecting Arduino with DS18B20

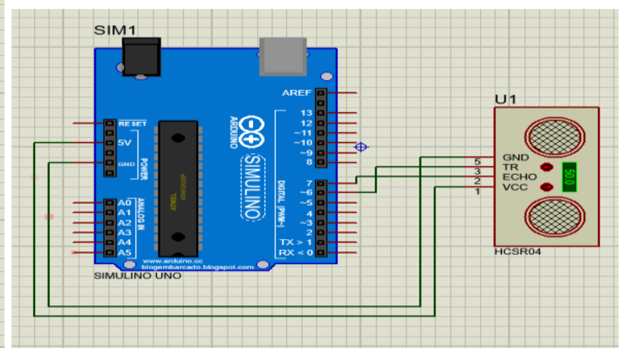


Fig 2: Connecting Arduino with HC-SR04

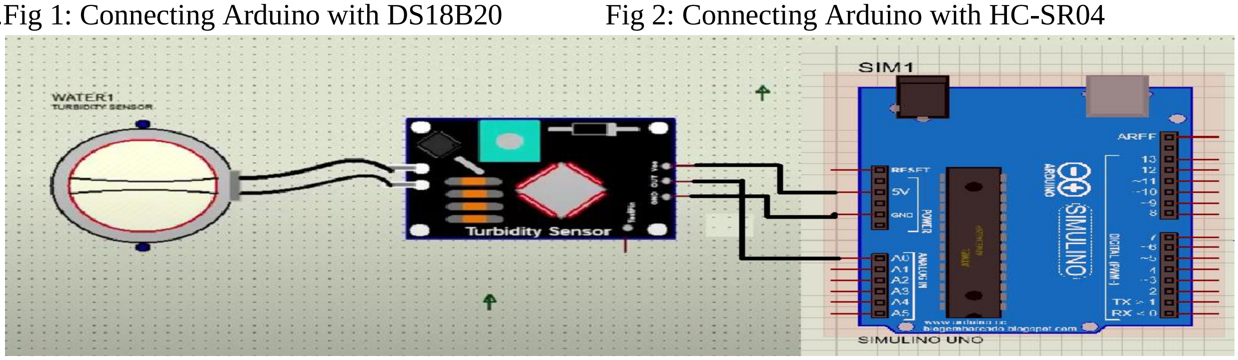


Fig 3: Connecting Arduino with Turbidity sensor

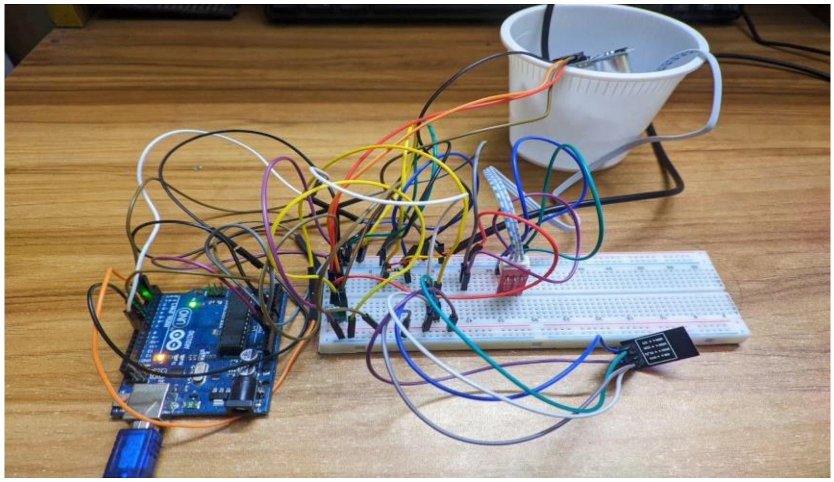


Fig 4: Circuit demonstration

A cloud platform was used to display the data. Using the wifi module the device was connected to the internet via WIFI. After connecting to the WIFI the data of temperature, water level and turbidity was sent to the platform. Using the graph chart, the data was successfully demonstrated. With an average wait time of 1 minute, the data was successfully shown in the cloud platform. Fig: 5 shows the demonstration of the cloud UI.

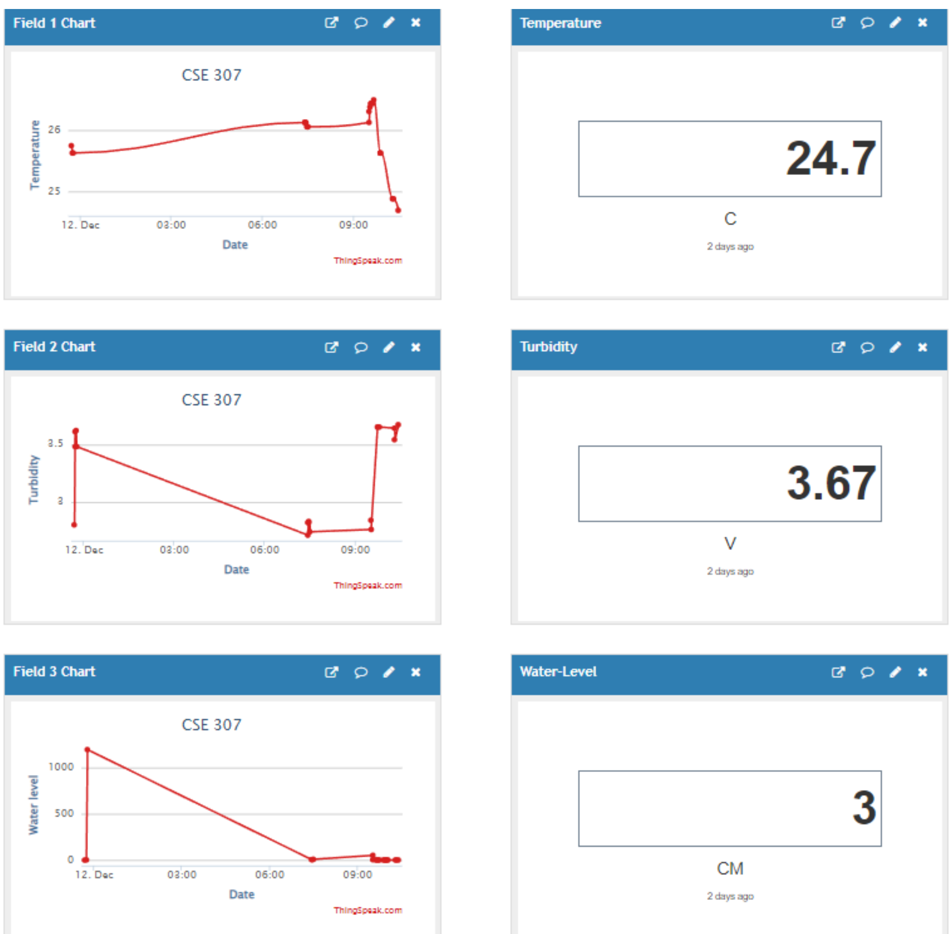


Fig 5: Cloud platform

Pseudocode:

Step 1: Define the connections of the sensors to the arduino pin

Step 2: Connect arduino to the internet using the wifi module
Step 3: Get temperature data in celsius
Step 4: Get voltage from turbidity data
Step 5: Using trigger and echo pin from HC-SR04 sensor get the water level
Step 6: Using ESP8266-ESP01 board, send the data to the cloud.

Using the Arduino IDE, the program was successfully written [16].

4 User Feedback and Future Goals

The device has been tested in small lakes and home made ponds. Using the device it was easy to monitor the quality of water. The user was able to take necessary precautions to avoid the damage of water quality in the pond or aquarium. For the data sent on the cloud platform, the data was successfully sent there at an average rate of 1 min and the data that was being displayed was accurate.

In order to advance our project, we'll add a pH sensor to make sure the pH is between 6.5 and 9.0 and a DO probe to make sure the water has the right quantity of dissolved oxygen (0.3–0.5 mg/liter), which is ideal for carp fish. We also intend to incorporate a servo meter for automatic water exchange. Using the automatic water exchange, water can be monitored and maintained automatically. The concept of machine learning can also be used here. With enough data collected, it will be possible to predict the quality of water at certain seasons and take necessary precautions.

5 Conclusion

We designed a monitoring system using Arduino for carp fish cultivation ponds in this paper. Water quality is one of the primary obstacles to carp fish production, so we sought to address this issue by ensuring the fundamental conditions with the use of a temperature sensor, an ultrasonic sensor, and a turbidity sensor. Bangladesh has a huge potential in the fish economy. And out of all fish cultivation in the country carp fish cultivation tops the list with 33.49% prediction every year. However we think that this production rate can be increased with the right quality control of the fish pond. With quality control of the pond we can easily increase the amount of cultivation of carp fishes. With lots of potential in this field we want to enhance this technology and increase its utility.

6 Reference

1. Harun, Z., Reda, E., & Hashim, H. (2018, March). Real-time fish pond monitoring and automation using Arduino. In *IOP Conference Series: Materials Science and Engineering* (Vol. 340, No. 1, p. 012014). IOP Publishing.
2. Idachaba, F. E., Olowoleni, J. O., Ibhaze, A. E., & Oni, O. O. (2017, October). IoT-enabled real-time fishpond management system. In *Proceedings of the World Congress on Engineering and Computer Science* (Vol. 1, pp. 25-27).
3. Salih, N. A. J., Hasan, I. J., & Abdulkhaleq, N. I. (2019). Design and implementation of a smart monitoring system for water quality of fish farms. *Indonesian Journal of Electrical Engineering*

and Computer Science, *14*(1), 44-50.

4. Nugraha, A. T., & Priyambodo, D. (2020). Design of Pond Water Turbidity Monitoring System in Arduino-based Catfish Cultivation to Support Sustainable Development Goals 2030 No.9 Industry, Innovation, and Infrastructure, Journal of Electronics, Electromedical and Medical Informatics (JEEEMI), 2, 119-124
5. Mohsin, A. B. M., Islam, M. N., Hossain, M. A., & Galib, S. M. (2012). Constraints and prospects of carp production in Rajshahi and Natore districts, Bangladesh. *University Journal of Zoology, Rajshahi University*, *31*, 69-72.
6. Hairol, K. N., Adnan, R., & Ruslan, F. A. (2018, December). Aquaculture Monitoring System using Arduino Mega for Automated Fish Pond System Application. In *2018 IEEE Conference on Systems, Process and Control (ICSPC)* (pp. 218-223). IEEE..
7. Islam, M. M., Kashem, M. A., & Uddin, J. (2022). An internet of things framework for real-time aquatic environment monitoring using an Arduino and sensors. *International Journal of Electrical and Computer Engineering*, *12*(1), 826.
8. Fiddariani, A. S., & Oktiawati, U. Y. (2021, October). Design and Implementation of Temperature and pH Monitoring Tools in Fish Pond Based on Arduino and Processing. In *2021 13th International Conference on Information Technology and Electrical Engineering (ICITEE)* (pp. 214-219). IEEE.
9. Roy, D. (2016). LARGE SCALE FISH PRODUCTION THOUGH CARP POLYCULTURE SYSTEM IN A FISH FARM IN BANGLADESH. *Vestnik of Astrakhan State Technical University. Series: Fishing Industry*, (4).
10. Raj, A. A., Swasthik, V. K., Rakesh, A., & Saravanaraj, D. M. (2020). Arduino based Fish Monitoring System. *International Journal of Scientific & Engineering Research*, *11*(7), 1622-1627.
11. Dr.A.Albert Raj., Dr.Selvan., Swasthik V.K., Rakesh .A.,Saravanaraj D.M.(2020).Arduino Fish Monitoring System.International Journal of Scientific & Engineering Research,11.
12. Eng. Nocheski S., Prof. D-r. Eng. Naumoski A.(2018).WATER MONITORING IOT SYSTEM FOR FISH FARMING PONDS.INTERNATIONAL SCIENTIFIC JOURNAL "INDUSTRY 4.0",77-79.
13. Khan.M.M.An IoT Based Smart Water Monitoring System for Fish Farming in Bangladesh.Journal Name2020,doi:10.3390/.
14. HUSSEIN. A. MOHAMMED, INTISAR AL-MEJIBLI.(2018).SMART MONITORING AND CONTROLLING SYSTEM TO ENHANCE FISH PRODUCTION WITH MINIMUM COST.Journal of Theoretical and Applied Information Technology,96.
15. P. Chinni Krishna, M. Venkateswara Rao, V. Ramesh Reddy.(2019).An Iot Based Fish Health Monitoring System In Aquaculture Farming.International Journal of Innovative Technology and Exploring Engineering (IJITEE),8.
16. Arduino, S. A. (2015). Arduino. *Arduino LLC*, *372*.
17. Mesquita, J., Guimarães, D., Pereira, C., Santos, F., & Almeida, L. (2018, September). Assessing the ESP8266 WiFi module for the Internet of Things. In *2018 IEEE 23rd International Conference on Emerging Technologies and Factory Automation (ETFA)* (Vol. 1, pp. 784-791). IEEE.
18. Fezari, M., & Al Dahoud, A. (2018). Integrated development environment "IDE" for Arduino. *WSN applications*, 1-12.
19. Carullo, A., & Parvis, M. (2001). An ultrasonic sensor for distance measurement in automotive applications. *IEEE Sensors journal*, *1*(2), 143.
20. Maureira, M. A. G., Oldenhof, D., & Teernstra, L. (2011). ThingSpeak–an API and Web Service for the Internet of Things. *World Wide Web*.