# Documentation

*Team 01*

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## Team members

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## Introduction

In this project, we are aiming to develop a Smart Beehive system to help beekeepers with monitoring the microclimate inside the beehive remotely using their mobile phones or web service. Thus, to check whether the beehive is healthy or not, we will focus on monitoring two main factors which are the humidity and temperature. It is important to mention that, for a healthy bee colony, the temperature should be within the range of 32 to 35 C and between 50-60% for humidity. As a result, our system will cool/heat the beehive in case the humidity and/or the temperature exceed or be less than the acceptable ranges.

## Concept description

Wireless sensor networks are widely used in several applications, especially in agriculture to improve production efficiency and effectiveness. Thus, our WSN targets the apiculture area of agriculture and it consists of a distributed system that is encapsulated in the form of sensing devices to measure the microclimate inside the beehive. The used sensor is integrated for collecting data regarding temperature and humidity.

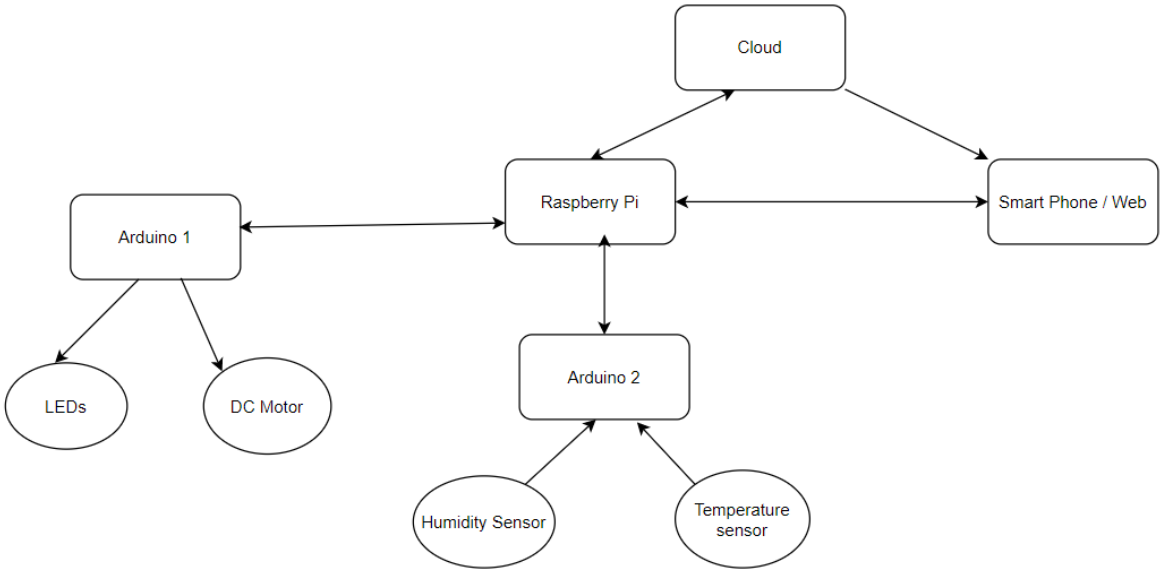


**Fig.1 Block Diagram of the Smart Beehive**

This figure illustrates the concept of our system. As shown in the block diagram our Wireless Sensor Network system uses the Raspberry Pi as a base communication node between the two subsystems. The sensor node represented by Arduino 1 will be placed inside the

beehive. The type of this Arduino is Wifi R2 and it is responsible for collecting data from the sensors which are the temperature and humidity sensors (we may use one sensor that encapsulates both functions). The second subsystem (Arduino 2), which has the same type as the first part of the system will be attached outside the beehive near its entrance. The second part is composed of two actuators which are a DC motor that will act as a cooling/heating system and LEDs which will be used as indicators for how healthy the beehive is. Thus, in case of having an abnormal percentage of humidity, and/or an unusual temperature rate, the red LED will be turned on. However, if the microclimate is healthy then the green LED will be turned on.

The MQTT communication is also a big part of this system, where both Arduinos will exchange data with the Raspberry Pi in order to send data from one part and react upon it in the other part. Besides, the Raspberry Pi will share the exchange with the smartphone/ web and share it with the cloud too.

**The Main parts of our proposed system are:**

1. 1 x RGB LED Actuator
2. 1 X Humidity/Temperature Sensor
3. 1 x DC Motor
4. 1 X Raspberry Pi
5. 2 X Microcontrollers: Arduino Uno Wifi R2
6. 1 X SmartPhone
7. 1 X Web page
8. Cloud

# Project/Team management

*Which project methods you used in your project?: V model or scrum….*
*Breakdown: How you managed your tasks?*
*What are the different tasks/roles of the team members in the project?*
*Describe which team member did which tasks.*

# Technologies

*Describe the technological approaches you will use to implement your project.*

- *Sensor technologie(s)*
- *Communication protocol(s)*
- *programming language(s)*
- *...*

# Implementation

*Describe the static structure of the environment.*
*Provide a class diagram for this purpose and briefly explain the classes or modules.*
*Describe the use case(s) of your environment*

## Use Case

*Give instructions on how to use your application. Potentially using an/more example(s), figures, screenshots etc.*

## Sources/References

*Provide the sources on the technologies and algorithms you used in your project (Github).*