Internet of Things (IoT)

Intelligent and Digital Manufacturing

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# Executive Summary

# Introduction

# What is Internet of Things (IoT)

# Experiment

## Premise

## Breakdown

## Outcome

# Our Findings/Experience

# Applications in the industry

# Security Concerns and implementation

# Next Steps for IoT

Within the next five to ten years, Internet of Things is expected to undergo rapid growth to support an increased user interface. To succeed in developing a technology that will continue to make societal impacts and leave a lasting footprint in technological history. Internet of Things will need to focus on the following areas of development:

## 7.1 Security and Regulation

As internet crime increasingly continues to rise (125% in 2021 compared to 2020), cybersecurity and the regulation of the same is an important focus for the developers of Internet of Things technology.

Internet of Things developers are expected to incorporate practical cybersecurity measures such as encryption, certificate-based authentication, and security standardization across platforms.

Developers of the Internet of Things will be challenged by ensuring the technology and security measures conform to privacy legislation across global jurisdictions. In Canada, developers must ensure they comply with the federal Personal Information Protection and Electronic Documents Act.

## 7.2 Trends in Technology

A large focus of developers of the Internet of Things throughout the development of the technology will be to keep up with ever-changing trends and societal progression. As society evolves, technology is expected to become ever more integrated into the consumer’s daily life.

Internet of Things is expected to expand to a futuristic society that incorporates technology such as smart cities, wearables, and transportation. As such, developers are expected to focus much of their attention on ensuring the Internet of Things technology is advanced in a way that can support such a change in global societies.

## 7.3 Market Growth

It is important for developers of Internet of Things technology to be aware of the differing market needs and industries of the many users of the technology. For example, the needs and wants of a user of wearable technology will differ greatly from a user of medical technology.

Developers will have to implement practical approaches and apply revolutionary as well as precedent techniques to ensure that different industries are accommodated. This will ensure a smooth transition to the use of Internet of Things technology.

Despite the many challenges that the developers of Internet of Things technology will face in the coming years, there is no doubt that the Internet of Things will have a significant impact on society as a whole.

# Conclusion

# References

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# 

# Appendix

## Screenshot 2024-03-03 at 11.10.02 AM.pngScreenshot 2024-03-03 at 11.06.37 AM.png1. Arduino MKRWfFi1010V2.0 Schematic

## 2. Raw Experiment Data

| **Time** | **Humidity** | **Temperature** |
| --- | --- | --- |
| 2024-02-23T00:15:07.154216356Z | 870.5 | 640.2999877929690 |
| 2024-02-23T00:15:27.16232095Z | 870.5999755859380 | 640.2000122070310 |
| 2024-02-23T00:16:07.189374697Z | 870.7000122070310 | 640.0999755859380 |
| 2024-02-23T00:16:27.197187536Z | 870.5999755859380 | 640.2000122070310 |
| 2024-02-23T00:17:27.372441351Z | 870.5 | 640.0999755859380 |
| 2024-02-23T00:17:47.223373163Z | 870.7000122070310 | 640.2000122070310 |
| 2024-02-23T00:18:27.23820977Z | 870.5999755859380 | 640 |
| 2024-02-23T00:18:47.65518405Z | 870.7000122070310 | 640.0999755859380 |
| 2024-02-23T00:19:07.293200722Z | 870.5999755859380 | 640 |
| 2024-02-23T00:19:27.298825208Z | 870.7000122070310 | 640.0999755859380 |
| 2024-02-23T00:19:47.306921705Z | 870.5999755859380 | 640 |
| 2024-02-23T00:20:07.315180638Z | 870.7000122070310 | 640.0999755859380 |
| 2024-02-23T00:21:07.741060404Z | 871.0999755859380 | 640.5999755859380 |
| 2024-02-23T00:21:27.371427129Z | 845.5 | 640.5 |
| 2024-02-23T00:21:47.449481926Z | 0 | 0 |
| 2024-02-23T00:23:11.921398119Z | 0 | 0 |
| 2024-02-23T00:25:34.866884658Z | 0 | 0 |
| 2024-02-23T00:25:49.308228086Z | 819.7999877929690 | 666.2000122070310 |
| 2024-02-23T00:27:03.422177734Z | 819.7999877929690 | 665.7999877929690 |
| 2024-02-23T00:27:19.556141981Z | 33.29999923706060 | 665.7999877929690 |
| 2024-02-23T00:27:39.562747806Z | 33.5 | 25.5 |
| 2024-02-23T00:27:59.575034211Z | 34 | 25.399999618530300 |
| 2024-02-23T00:28:19.583631639Z | 33.5 | 25.5 |
| 2024-02-23T00:29:39.617700076Z | 33.599998474121100 | 25.399999618530300 |
| 2024-02-23T00:29:59.623955856Z | 33.70000076293950 | 25.299999237060500 |
| 2024-02-23T00:30:39.960013182Z | 33.79999923706060 | 25.200000762939500 |
| 2024-02-23T00:30:59.661877726Z | 33.900001525878900 | 25.100000381469700 |
| 2024-02-23T00:31:39.685076624Z | 34 | 25.200000762939500 |
| 2024-02-23T00:31:59.701111112Z | 86.5999984741211 | 25.100000381469700 |
| 2024-02-23T00:32:19.903859517Z | 81.30000305175780 | 26 |
| 2024-02-23T00:32:39.715065425Z | 60.20000076293950 | 26.200000762939500 |
| 2024-02-23T00:32:59.728030558Z | 38.79999923706060 | 25.799999237060500 |
| 2024-02-23T00:33:19.75402825Z | 36.79999923706060 | 25.5 |
| 2024-02-23T00:33:40.191138091Z | 36.29999923706060 | 25.399999618530300 |
| 2024-02-23T00:33:59.768802624Z | 36 | 25.200000762939500 |
| 2024-02-23T00:34:19.785873899Z | 35.79999923706060 | 26 |
| 2024-02-23T00:34:39.792169472Z | 35.70000076293950 | 27.799999237060500 |
| 2024-02-23T00:34:59.801103872Z | 35.599998474121100 | 25.799999237060500 |
| 2024-02-23T00:35:20.131639357Z | 71.80000305175780 | 25.700000762939500 |
| 2024-02-23T00:35:39.81817694Z | 95 | 25.5 |
| 2024-02-23T00:35:59.847205574Z | 58.5 | 25.299999237060500 |
| 2024-02-23T00:36:19.842703549Z | 39.5 | 25.200000762939500 |
| 2024-02-23T00:36:40.004774028Z | 37.099998474121100 | 25.100000381469700 |
| 2024-02-23T00:36:59.862867658Z | 36.400001525878900 | 25.200000762939500 |
| 2024-02-23T00:37:19.872705943Z | 36.099998474121100 | 25.100000381469700 |
| 2024-02-23T00:37:39.883085759Z | 36 | 25 |
| 2024-02-23T00:37:59.908612733Z | 35.79999923706060 | 25.100000381469700 |
| 2024-02-23T00:38:20.357643565Z | 35.599998474121100 | 24.899999618530300 |
| 2024-02-23T00:38:39.913532292Z | 35.5 | 25.200000762939500 |

## 3. Arduino Boilerplate Code

/\*

Sketch generated by the Arduino IoT Cloud Thing "MKR WiFi 1010 and DHT22"

https://create.arduino.cc/cloud/things/e75efe13-eb5e-432a-86d3-0bf1cd34aaac

Arduino IoT Cloud Variables description

The following variables are automatically generated and updated when changes are made to the Thing

CloudTemperatureSensor temperature;

CloudRelativeHumidity humidity;

Variables which are marked as READ/WRITE in the Cloud Thing will also have functions

which are called when their values are changed from the Dashboard.

These functions are generated with the Thing and added at the end of this sketch.

\*/

#include "thingProperties.h"

#include <Adafruit\_Sensor.h>

#include <DHT.h>

#include <DHT\_U.h>

#define DHTPIN 7 // Digital pin connected to the DHT sensor

#define DHTTYPE DHT22 // Write DHT11 or DHT22 According to your Sensor

DHT\_Unified dht(DHTPIN, DHTTYPE);

uint32\_t delayMS;

unsigned long previousMillis = 0;

const long interval = 20000; //milliseconds total time for 20 Seconds

void setup() {

// Initialize serial and wait for port to open:

Serial.begin(9600);

// This delay gives the chance to wait for a Serial Monitor without blocking if none is found

delay(1500);

// Defined in thingProperties.h

initProperties();

// Connect to Arduino IoT Cloud

ArduinoCloud.begin(ArduinoIoTPreferredConnection);

/\*

The following function allows you to obtain more information

related to the state of network and IoT Cloud connection and errors

the higher number the more granular information you’ll get.

The default is 0 (only errors).

Maximum is 4

\*/

setDebugMessageLevel(2);

ArduinoCloud.printDebugInfo();

dht.begin(); //Init DHT

Serial.println(F("DHTxx Unified Sensor Example"));

// Print temperature sensor details.

sensor\_t sensor;

dht.temperature().getSensor(&sensor);

Serial.println(F("------------------------------------"));

Serial.println(F("Temperature Sensor"));

Serial.print (F("Sensor Type: ")); Serial.println(sensor.name);

Serial.print (F("Driver Ver: ")); Serial.println(sensor.version);

Serial.print (F("Unique ID: ")); Serial.println(sensor.sensor\_id);

Serial.print (F("Max Value: ")); Serial.print(sensor.max\_value); Serial.println(F("°C"));

Serial.print (F("Min Value: ")); Serial.print(sensor.min\_value); Serial.println(F("°C"));

Serial.print (F("Resolution: ")); Serial.print(sensor.resolution); Serial.println(F("°C"));

Serial.println(F("------------------------------------"));

// Print humidity sensor details.

dht.humidity().getSensor(&sensor);

Serial.println(F("Humidity Sensor"));

Serial.print (F("Sensor Type: ")); Serial.println(sensor.name);

Serial.print (F("Driver Ver: ")); Serial.println(sensor.version);

Serial.print (F("Unique ID: ")); Serial.println(sensor.sensor\_id);

Serial.print (F("Max Value: ")); Serial.print(sensor.max\_value); Serial.println(F("%"));

Serial.print (F("Min Value: ")); Serial.print(sensor.min\_value); Serial.println(F("%"));

Serial.print (F("Resolution: ")); Serial.print(sensor.resolution); Serial.println(F("%"));

Serial.println(F("------------------------------------"));

// Set delay between sensor readings based on sensor details.

delayMS = sensor.min\_delay / 1000;

STHAM();

}

void loop() {

ArduinoCloud.update();

// Your code here

unsigned long currentMillis = millis();

if (currentMillis - previousMillis >= interval) {

STHAM();

previousMillis = currentMillis;

}

}

void STHAM(){

// Get temperature event and print its value.

sensors\_event\_t event;

dht.temperature().getEvent(&event);

if (isnan(event.temperature)) {

Serial.println(F("Error reading temperature!"));

//Assign temperature value 0 to Cloud Variable

temperature=0;

}

else {

Serial.print(F("Temperature: "));

Serial.print(event.temperature);

Serial.println(F("°C"));

//Assign temperature value to Cloud Variable

temperature=event.temperature;

}

// Get humidity event and print its value.

dht.humidity().getEvent(&event);

if (isnan(event.relative\_humidity)) {

Serial.println(F("Error reading humidity!"));

//Assign humidity value 0 to Cloud Variable

humidity=0;

}

else {

Serial.print(F("Humidity: "));

Serial.print(event.relative\_humidity);

Serial.println(F("%"));

//Assign humidity value to Cloud Variable

humidity=event.relative\_humidity;

}

}

/\*

Since Temperature is READ\_WRITE variable, onTemperatureChange() is

executed every time a new value is received from IoT Cloud.

\*/

void onTemperatureChange() {

// Add your code here to act upon Temperature change

}

/\*

Since Humidity is READ\_WRITE variable, onHumidityChange() is

executed every time a new value is received from IoT Cloud.

\*/

void onHumidityChange() {

// Add your code here to act upon Humidity change

}