

Portable weather systems

by Ryan O'Sullivan

FILE	3258_RYAN_OSULLIVAN_PORTABLE_WEATHER_SYSTEMS_85042_459570693.ODT (4.25M)		
TIME SUBMITTED	06-JAN-2018 05:04 PM (UTC+0000)	WORD COUNT	8610
SUBMISSION ID	80922702	CHARACTER COUNT	62321



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Review of portable weather measurement systems

In this literature review, we will be looking at the specifications of some of the portable weather measurement systems available already

Portable weather system have many different uses from domestic use in-house and gardens from systems that are used in hazardous conditions. These can vary a lot in what sensor are built in, or sold as extras. With some extra power systems build in such as solar panels or wind turbines can greatly increase how long these sensor run mean more data can be collected over a longer period of time. Other sensors that provide wind direction allowed to calcite a directional spread of particles and weather conditions. Wind speed sensors can help with dangerous wind speeds this can also help with calculating speed spread of particles. A particle sensor has many uses such as detecting hazardous material in the air.

This can cause many health issues if not keep under control. A UV sensor can be vital if you trying to keep outdoor material away from UV rays these can be such thing as barrels of oil that might ignite at high tempter UV rays by increasing the tempura of metal barrels. A tempura sensors can also provide the same protection if your worry abought high heat. Being able to measure weather conditions can be really helpful for the understanding of the local environment. But weather sensor can also have many other uses not just collecting data of weather condition. Most of these weather sensor have built-in data logger collecting all results for late analysis. These can sometimes have a downside of going back to the sensor to collect the data but a lot more sensor and transmitting its data so that it is completely self-efficient. Reviewing 4 Weather systems for this assignment form the industry sensor such as the HM-1 and consumer product such as the Ambient Weather WM-4 Handheld Weather Station that is a handheld portable weather system. These 4 product should show the whole spectrum of systems.

In this literature review, we will be looking at the specifications of some of the portable weather measurement systems available already

Some of the main points regarding specification will be

- How the data is held (seize of data storage/how it viewed)
- The speed of the data being read(sample rate)
- Martial and protection of outer casing
- Able to have enough power to last a week
- Be Accuracy in In Cold/hot weather
- Able to store enough data

Rain Wise HM-1 Portable HAZMAT Weather Station

This weather station is mainly designed for the first responder to hazardous material incidents. Providing real-time information monitoring systems. This system can provide a wind range speed of 0-50mph these are used to calculate the spread of hazardous material Helped with 0-360° wind direction range.

Supporting many sensors with temperature sensor -45 to 74°C Dew point 45 to 74° Relative humidity 0-100%.

Displaying real-time results supporting battery life of 24 hours[12]



RDI-I DISPLAY AND COMPUTER INTERFACE

Displays

0.56" Red LED displays

Serial Interface

3 Wire RS-232, CAMEO / ALOHA supported
Third party software support for archiving

Data Logger Memory

32 KB Non-volatile RAM
Minimum logging interval: 1 minute
Capacity: 90 days at 1 hour rate

Data Logger Clock

Battery backed up Real-time clock
Accuracy: 1 minute per month

Power

Internal sealed lead-acid battery pack
AC powered option through battery charger
12VDC vehicle adapter
Battery Life: Greater than 24 hours

Physical

Weight: 4 Kgs (8.8 lbs)
Dimensions: 311 mm x 190 mm x 120 mm
(12.25" x 7.5" x 4.75")

Construction

Copolymer resin based, high impact plastic

TRIPOD & TRANSPORT CASE

Case

Weight: 21 Kgs (47 lbs)
(Complete system)
Dimensions: 914 mm x 483 mm x 356 mm
(36" x 19" x 14")
Construction: Copolymer resin based,
high impact plastic

Tripod

Height: 10 feet (maximum)
Construction: Aluminum, fiberglass and plastic
Copolymer resin based, high impact plastic

MADE IN THE USA

Along with all of our consumer and industrial products, the HM-1 is made in America.

5 YEAR WARRANTY

We are so confident that our equipment will stand up to the elements that we offer a 5 year warranty on all of our industrial stations including the HM-1. Rainwise is the only manufacturer in the weather station industry that has such an extensive guarantee.

HSA-I SENSOR ASSEMBLY

Wind Speed

Range: 0-67 ms-1 (0-150 mph)
Resolution: 0.45 ms-1 (1.0 mph)
Threshold: 0.45 ms-1 (1.0 mph)
Accuracy: $\pm 2\%$ of full scale

Wind Direction

Range: 0-360 – no dead band
Resolution: 1.0°
Accuracy: $\pm 3.0^\circ$

Temperature

Range: -45°C to 74°C (-50°F to +166°F)
Resolution: 1°C (1.0°F)
Accuracy: $\pm 0.27^\circ\text{C}$ ($\pm 0.5^\circ\text{F}$)

Dew Point

Range: -45°C to 74°C (-50°F to +166°F)
Resolution: 1°C (1.0°F)
Accuracy: $\pm 1.1^\circ\text{C}$ ($\pm 2.0^\circ\text{F}$)

Relative Humidity

Range: 0-100 %
Resolution: 1 %
Accuracy: $\pm 2.0\%$ (-40°C to +60°C)

Barometric Pressure

Range: 700 to 1100 millibars
(16.3 to 32 inches of Hg)
Resolution: 1 millibar (0.01 inches Hg)
Accuracy: ± 1.5 millibars (-10°C to +60°C)

Nuclear Radiation

Range: 0.1 to 50+ REMS / hour
Resolution: 0.1 REMS / hour

Radio Transmitter

(USA & Canada)
Range: 7 miles – line of sight
Frequency: 902.0 to 928 Mhz
(FCC approved – no license required)
(International)
Range: 3 miles – line of sight
Frequency: 2.4 Ghz (FCC, CE and ETSI approved)

Power

4 Alkaline D cells
Battery life: Greater than 1000 hours

Physical

Weight: 4 Kgs (8.8 lbs)
Dimensions: 160 mm x 240 mm x 240 mm
(6.3" x 9.5" x 9.5")

Vaisala WXT-520 Automatic Weather Station

The Vaisala WXT-520 is an automatic weather station contains all types of sensor for a weather station all packed into a single, compact case. with air temperature Sensors, relative humidity Sensors, barometric pressure Sensors, wind speed Sensors and direction Sensors (using a top quality sensor), With high resolution seeped allowing for the high rate of sensor readings.

This product can be programmed to adapt the performance of the sensor to give a large variety of different applications with its extremely compact design it's very easy to install no moving parts makes it extremely easy to maintain. Low power consumption[1]

Wind Speed	
Range	0 - 60m/s
Response Time	250ms
Available Variables	average, maximum, minimum
Accuracy 0-35ms	± 0.3m/s or ±3% (whichever is greater)
Accuracy 35-60ms	±5%
Resolution	0,1m/s
Units available	m/s, km/h, mph, knots
Wind Direction	
Azimuth	0 - 360°
Response Time	250ms
Available Variables	Average, maximum, minimum
Accuracy	±3°
Resolution	1°
Rainfall	
Hail Duration	counting each 10s increment whenever hail stone detected
Resolution	10s
Hail Intensity	one minute running average in ten-second steps
Resolution	0.1 hits/cm ² h (1hits/in ² h)
Units Available	hits/cm ² h, hits/inch, hits/h
Barometric Pressure	600 - 1.100hPa
Accuracy	± 0.5hPa at 0...+30°C (+32...+86°F) ± 1hPa at -52...+60°C (-60...+140°F)
Resolution	0.1hPa
Units Available	hPa, Pa, bar, mmHg, inHg
Air Temperature	-52°C - +60°C -60°F - +140°F
Accuracy @20°C (+68°F)	± 0.3°C (± 0.5°F)
Resolution	0,1°C (0.1°F)
Relative Humidity	0 - 100 %RH
Accuracy	± 3% RH within 0-90% RH ± 5% RH within 90-100% RH
Resolution	0.1% RH
Operating Temperature	-52°C to +60°C -60°F to +140°F
Height	240 mm (9.4")
Diameter	120 mm (4.7")
Weight	650 gr. (1.43 lbs)
Power Supply	5 - 30 VDC
Heating	optional
Heating power supply	12 or 24VDC, 68VAC

Ambient Weather WM-4 Handheld Weather Station

The Ambient Weather WM-4 is a compact small handheld weather station containing a directional compass wind speed, wind direction, temperature, relative humidity and compass direction, and calculates wind gust, dew point, wet bulb and dry bulb temperature, Delta T, wind chill and heat index.

This product is on the small end of the weather station category but does pack a lot of sensors in a small package [2]

Specifications:

Wind speed range: .8-89 mph

Wind speed accuracy: $\pm 3\%$ when aligned with winds axis

Current wind response time: 1-sec

Avg wind response time: over 10 sec

Max wind response time: 1-sec

Crosswind head/tailwind response time: 5 sec

Wind direction response time: 1 sec

Temperature range: -20° to $+158^{\circ}\text{F}$

Temperature accuracy: $\pm 1.8^{\circ}\text{F}$

Temperature response time: 1 min

Dew point range: -20° to $+158^{\circ}\text{F}$

Dew point accuracy: $\pm 3.6^{\circ}\text{F}$

Dewpoint response time: 1 min

Wet bulb accuracy: $\pm 3.6^{\circ}\text{F}$

Wet bulb range: 32° to 100°F

Wet bulb response time: 1-min

Wind chill range: -50° to $+50^{\circ}\text{F}$

Wind chill accuracy: $\pm 1.8^{\circ}\text{F}$

Wind chill response time: 1 sec

Rel. humidity range: 5-95%

Rel. humidity accuracy: $\pm 3\%$

Rel. humidity response time: 1 min

Delta T response time: 1-min

Compass accuracy: $\pm 2^{\circ}$

Compass range: 0 to 360

Compass response time: 1 sec

Other Specifications:

Power: CR2032 Lithium battery (included and replaceable)

Dimensions: 5.5" x 1.75" x .75"



Davis Instruments 6250-MOBILE Wireless Mobile Weather Station

The Davis Instruments 6250-MOBILE Wireless Mobile Weather Station is a all in one portable device it responds to has, at incidents giving immediate data and simulations it is highly accurate and affordable with wireless transmissions this helping the Davis Instruments to send data when a human cannot go and receive it cos of wealth conditions it updates every 2½ seconds give near live transmission. With a strong outer shell being able to stand the harshest environments it allows this product to stay active for longer without maintenance the system is an easy to install being able to make 0.5watts from it solar panel this device is able to last a long time without a recharge over 8moths battery life without any sun at all is perfect and over 2 years with good sunlight .[3]

Integrated Sensor Suite (ISS)

Operating Temperature	-40° to +150°F (-40° to +65°C)
Non-operating (Storage) Temperature	-40° to +158°F (-40° to +70°C)
Current Draw	0.20 mA (average), 30 mA (peak) at 3.3 VDC
Solar Power Panel	0.5 Watts
Battery	CR-123 3-Volt Lithium cell
Battery Life (3-Volt Lithium cell)	8 months without sunlight - greater than 2 years depending on solar charging
Wind Speed Sensor	Wind cups with magnetic detection
Wind Direction Sensor	Wind vane with magnetic encoder
Rain Collector Type	Tipping spoon, 0.01" per tip (0.2 mm with metric rain cartridge, Part No. 7345-319), 18.0 in ² (116 cm ²) collection area
Temperature Sensor Type	PN Junction Silicon Diode
Relative Humidity Sensor Type	Film capacitor element
Housing Material	UV-resistant ABS & ASA plastic
ISS Dimensions	12.95" x 5.75" x 13.40" (329 mm x 146 mm x 340 mm)
Package weight:	5.44 lbs (2.47 kg)



Console Specifications

Console Operating Temperature	+32° to +140°F (0° to +60°C)
Non-Operating (Storage) Temperature	+14° to +158°F (-10° or +70°C)
Console Current Draw	0.9 mA average, 30 mA peak. (add 120 mA for display lamps, add 0.125 mA for each transmitter station received by console) at 4.4 VDC
Power Adapter	5 VDC, 300 mA
Battery Backup	3 C-cells
Battery Life (no AC power)	Up to 5 months (approximately)
Housing Material	UV-resistant ABS plastic
Console Display Type	LCD Transflective
Display Backlight	LEDs
Dimensions:	
Console (with antenna)	7.5" x 5.75" x 4.5" (190 mm x 146 mm x 114 mm)
Console (with antenna) mounted on wall	7.5" x 7.0" x 3.0" (190 mm x 178 mm x 76 mm)
Display	4.13" x 3.0" (106 mm x 76 mm)
Weight (with batteries)	1.48 lbs. (.67 kg)

Microcontroller selection

The microcontroller needs to support inputs for-----

The **microcontroller** would have to be able to collect data over 7 days collecting a lot of reading from the sensor. processing a lot of this data and transferring it to the SD card so more data can be collected and stored better.

After working out what sensor was need the project was able to proceed to pick a microcontroller these are the specifications that were needed after viewing all the data sheet from final sensors selections.

Pins	Operat- ing Volt- age Range (V)	Clock speed	Digital inputs	Analog inputs	Ram	Program Memory Flash	Analog to digi- tal	Data bus	Digital Communi- cation Pe- ripherals
30+	0-5.5v	12- 16megs	3	6	160bit	16k	10ch+ 10-bit	8bits	1-UART, 1-SPI 1-usb I2C1

6 Microcontrollers are reviewed for this project but not all are suitable after reading all the datasheets from these PICs. With the project needing to handle a lot of connections and be able to run in a low power mode.

Pic16f1455

This chip offers a lot of power in a small 14 pin containing Flash Program Memory with self-read/write capability with 2x Standalone PWM Modules 10 Channel 10-bit ADC with Voltage Reference 2 Analog Comparators 5-bit Digital to Analog Converter (DAC) Enhanced Power-On/Off-Reset Extreme Low Power (XLP) 'LF' Variant (1.8V – 3.6V) These features allow for many uses.[5][6]

Parameter Name	Value
Program Memory Type	Flash
Program Memory (KB)	14
CPU Speed (MIPS)	12
RAM Bytes	1,024
Digital Communication Peripherals	1-UART, 1-SPI, 1-I2C1+ MSSP(SPI/I2C)
Capture/Compare/PWM Peripherals	2PWM
Timers	2 x 8-bit, 1 x 16-bit
ADC	5 ch, 10-bit
Comparators	2
USB (ch, speed, compliance)	1, FS Device
Temperature Range (C)	-40 to 125
Operating Voltage Range (V)	1.8 to 5.5
Pin Count	14
Low Power	Yes
Cap Touch Channels	5



Pic16f1459

The 16f14 family contains a lot of small devices that pack a punch in power boasting a 12MIPS CPU with on board Flash of memory of 14kb with 9 analog to digital channels allowing for a variety of I/O options Some features are High Endurance Flash Memory (HEF) 128 B of Non-volatile Data Storage Universal Serial Bus 2.0 Module with clock recovery from USB host 2x Standalone PWM Modules 10 Channel 10-bit ADC with Voltage Reference 2 Analog Comparators 5-bit Digital to Analog Converter (DAC) MI2C / SPI Module Wide Operation Voltage Variant 'F' (1.8V – 5.5V)[5][7]

Parameter Name	Value
Program Memory Type	Flash
Program Memory (KB)	14
CPU Speed (MIPS)	12
RAM Bytes	1,024
Digital Communication Peripherals	1-UART, 1-SPI, 1-I2C1- MSSP(SPI/I2C)
Capture/Compare/PWM Peripherals	2PWM
Timers	2 x 8-bit, 1 x 16-bit
ADC	9 ch, 10-bit
Comparators	2
USB (ch, speed, compliance)	1, FS Device
Temperature Range (C)	-40 to 125
Operating Voltage Range (V)	1.8 to 5.5
Pin Count	20
Low Power	Yes
Cap Touch Channels	9



PIC18f14k50

The smallest of the PIC18f family but still have all the ease of use as with a C Compiler optimized architecture Allowing use of USB with the USB v2.0 compliant interface Supports. Containing I2C/SPI Interface I²C™ ports 10-bit, 9-channel ADC Module Rail to Rail operation 1.8 to 5.6V Operating [5][8]

Parameter Name	Value
Program Memory Type	Flash
Program Memory (KB)	16
CPU Speed (MIPS)	12
RAM Bytes	768
Data EEPROM (bytes)	256
Digital Communication Peripherals	1-UART, 1-SPI, 1-I2C1- MSSP(SPI/I2C)
Capture/Compare/PWM Peripherals	1 Input Capture, 1 ECCP,
Timers	1 x 8-bit, 3 x 16-bit
ADC	9 ch, 10-bit
Comparators	2
USB (ch, speed, compliance)	1, FS Device
Temperature Range (C)	-40 to 125
Operating Voltage Range (V)	1.8 to 5.5
Pin Count	20
Low Power	Yes
Cap Touch Channels	9



Pic18f24l50

The 28 pin Pic18f2450 contains 1-UART, Program Memory (KB) 16 ADC 10 ch, 10-bit this chip is compact Full Speed USB applications (12Mbit/s). The Enhanced Flash program memory allows operation when disconnected from the bus and easy field upgrades via the USB port. [9][10]

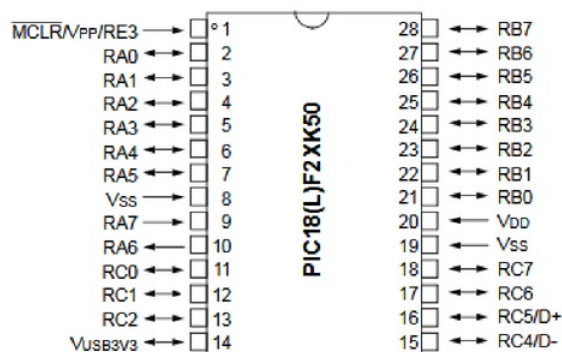
Parameter Name	Value
Program Memory Type	Flash
Program Memory (KB)	16
CPU Speed (MIPS)	12
RAM Bytes	768
Digital Communication Peripherals	1-UART,
Capture/Compare/PWM Peripherals	1 Input Capture, 1 CCP,
Timers	1 x 8-bit, 2 x 16-bit
ADC	10 ch, 10-bit
USB (ch, speed, compliance)	1, FS Device
Temperature Range (C)	-40 to 85
Operating Voltage Range (V)	2 to 5.5
Pin Count	28



Pic18f25k50

This chip would have been perfect for the project contain 32 (KB) Program Memory 28 pint USB capability 14chanel of 10 bits Analog-digital conversion. 2048bytes of ram would have been plenty as SPI ports allow an external SD card that will be added. With an operating voltage range of 1.8v to 5.5v. A low price range of £1.84 per 1-25 this chip would be useful for many projects. [5] Reviewing this Pic from perverse project as it suited both projects[9][11]

Parameter Name	Value
Program Memory Type	Flash
Program Memory (KB)	32
CPU Speed (MIPS)	12
RAM Bytes	2,048
Data EEPROM (bytes)	256
Digital Communication Peripherals	1-UART, 1-SPI, 1-I2C1- MSSP(SPI/I2C)
Capture/Compare/PWM Peripherals	1 CCP, 1 ECCP,
Timers	2 x 8-bit, 2 x 16-bit
ADC	14 ch, 10-bit
Comparators	2
USB (ch, speed, compliance)	1, FS Device
Temperature Range (C)	-40 to 125
Operating Voltage Range (V)	1.8 to 5.5
Pin Count	28
Low Power	Yes
Cap Touch Channels	14

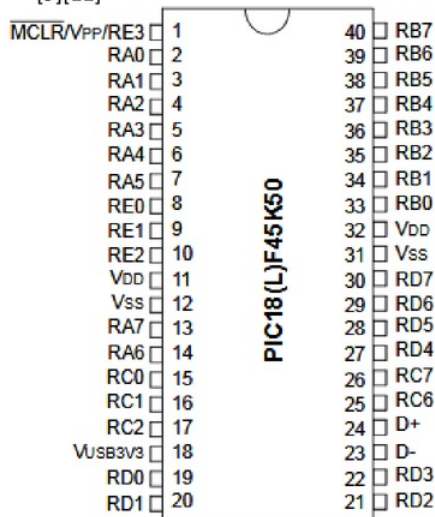


Pic18f45k50

This 40 pin chip is perfect for a future aspect of the device. Allowing more sensors to be added for more accurate readings. This chip would be able to handle most projects and it contains High-performance PIC18 core these family of chips are powerful chips being able to work at a fast rate and not losing on ports and power consumption.

The Enhanced Addressable USART Module will allow for faster data transfer. Working on a low power consumption reviewing this Pic from perverse project as it suited both projects

[9][11]



Parameter Name	Value
Program Memory Type	Flash
Program Memory (KB)	32
CPU Speed (MIPS)	12
RAM Bytes	2,048
Data EEPROM (bytes)	256
Digital Communication Peripherals	1-UART, 1-SPI, 1-I2C1- MSSP(SPI/I2C)
Capture/Compare/PWM Peripherals	1 ECCP,
Timers	2 x 8-bit, 2 x 16-bit
ADC	25 ch, 10-bit
Comparators	2
USB (ch, speed, compliance)	1, FS Device
Temperature Range (C)	-40 to 125
Operating Voltage Range (V)	1.8 to 5.5
Pin Count	40
Low Power	Yes
Cap Touch Channels	25

Package for the system

TEMPO ABS Enclosure, IP65, 289 x 239 x 107.4mm
£20.41 This is product will be used in this project[13]

This tempo enclosure from fibox is easy to use and assemble. Made of PVC and coming in partial dimensions this is ip65 protected with all hinges and screws covered to optimal seal

With an IK 07 shockproof protecting inner goods and Operating temperature (continuous): - 40 ° → + 60 °C

X8 Series Hinged Lid Enclosures 350.00

The X8 Series Hinged Lid Enclosures has IP66/67 rated enclosure and IK07/08 impact tested the Heavy duty hinge and latch enclosure help with protecting the seals on the enclosure with a PCB pillars in the base for PCB mounting[14]

IP65 ABS Enclosure - 240x190x90mm - GR17014

A general purpose enclosure designed for housing electronic and electrical equipment, making it ideal for electricians, engineers, with an ip65 seal on the enclosure with many different diameters [15]

☐ Enclosure Type:	Multipurpose	☐ Body Colour:	Grey
☐ Enclosure Material:	ABS	☐ External Height - Imperial:	9.45"
☐ IP Rating:	IP65	☐ External Width - Imperial:	7.48"
☐ NEMA Rating:	-	☐ External Depth - Imperial:	3.54"
☐ External Height - Metric:	240mm	☐ Product Range:	Ce-Tek GR Series ABS Enclosures
☐ External Width - Metric:	190mm		
☐ External Depth - Metric:	90mm		

Storage

USB

ASSMANN WSW Right Angle, Through Hole Type A USB Connector, Receptacle £0.634[16]

Wurth Elektronik WR-COM Series, Through Hole Type A USB Connector, Receptacle £1.85[17]

SD Card

Hirose 8 Way Right Angle Micro SD Memory Card Connector with Solder Termination £1.66 [18]

JST 8 Way Micro SD Memory Card Connector with Snap-In Termination £0.965[19]

SanDisk SDSDU-064G-U46 Ultra Class 10 Memory Card up to 30 MB/s read - 64 GB £22.99[20]

Buttons/ Connector/ Switch

SPST-NO Momentary Miniature Push Button Switch, IP67, Panel Mount £9.28 at uk.rs-online.com[21]

This was the chosen for the portable weather system in this Report



SPST Momentary, Off Miniature Push Button Switch, IP67, 13.6 (Dia.)mm, Square Threaded Yellow LED £2.25 at uk.rs-online.com[22]



Toggle Switch IP65 DPDT On-On, 3 A @ 250 V ac, Panel Mount Illuminated £6.62 at uk.rs-online.com

This was the chosen for the portable weather system in this Report[23]



Jaeger, 6 Pole Cable Mount Connector Plug, IP65, 1 Shell Size, Male Contacts £40 [24]



Jaeger 5324 Series, 6 Way Cable Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 1 £18.00 [25]



Temperature sensor

Pro TT531/10K3A1

Temperature Sensors for Air Conditioning

This Thermistor is suitable for most conditioning a baseline temperature (10kΩ at 25°C) 2 wire sensors with brass probes providing a linear response output. Temperature range -10 to +60°C an IP65 housing, maximum temperature 110°C.[26]



Application	Outside Air
Sensing Element Type	Thermistor
Maximum Temperature Sensed	+40 °C, +110 °C
Minimum Temperature Sensed	-10°C
Range of Temperatures Sensed	-10 → +110 °C, -10 → +40 °C

RTD Sensor, Indoor, Outdoor

The RTD outdoor temperature sensor is a Rugged product with an IP protection of 65 being able to use indoors and outdoors it provides a linear response With one wire output with an anlage output. [27]

- For temperatures from -50 to +90°C (200°C)
- IP65 Protection degree
- 1x Pt 100 in 2-wire circuit measuring insert
- Tolerance class as per DIN EN 60 751 class B (standard)
- Cable screw-connection (IP65)



The Zertico Monitoring System

The Zertico Temperature Sensor is used for the monitoring and measurement temperature in outdoor. Weatherproof 15 m long RJ-11 Cable With a measurement range temperature of 140 up to 100°C There is no power need to supply this device. [28]



Technical specifications:

Useable for:	all Zertico Rack Monitoring Systems and PDU's
Measurement range temperature:	-40° up to 100°C / -40°F up to 212°F
Accuracy temperature sensor:	± 1°C / 1.8°F
Maximum distance:	100 meters with optional RJ11 patch cable
Autosense function:	This sensor is detected automatically by all Zertico appliances
Net weight:	0,450 kg
Dimensions:	Device represents cylinder of Ø 8x25mm with 15m cable
Power:	powered by Zertico Appliance, no power supply needed

Loxone OUTSIDE TEMPERATURE & HUMIDITY

This was the chosen sensor for the probable weather system this will be talked about twice as it was chosen for the Humidity sensor too

This product supports two sensors in one handy case with TEMPERATURE & HUMIDITY All running on 10vs these two sensors bundled together made it an easy choice for this product with High long-term stability, High quality with a measuring range of -30 to +70°C [29]

FEATURES

- Standard 0-10V signal
- Humidity measurement linearized
- Compensated temperature measurement
- High long-term stability
- High-quality enclosure
- Integrated temperature-voltage converter



Humidity	
Measurement range	0 ... 100% r.h.
Accuracy	±/- 2% r.h. (between 10% ... 90% r.h.)
Sensor element	Combined (humidity and temp)
Temperature	
Measurement range	-30°C ... +70°C
Accuracy	±/- 0.3°K (between 0°C ... +60°C)
General	
CE conformity	89/336/EWG
EMC emissions	EN 61000-6-3:2001
Sensor dimensions	See dimensions
Enclosure material	Polymide GK30
Connection	Screw terminals 1.5mm ²
Filter	Sintered polyethylene 40µm
Operating voltage	15-36 VDC / 24 VAC
Surge protection	Varistor
Operating temperature	-30°C ... +70°C
Protection class	IP65
Please not technical specifications may change at any time!	

Humidity Sensor

SHO100 - room humidity outdoor sensor

This Electric outdoor Relative Humidity is an ideal solution for measuring relative humidity. This has excellent reliability, long-term stability with the strong ip65 case, and fast accurate response to changes in humidity. Rugged housings ensure long life and protection against daily exposure to a variety of weather conditions. Operating on a 0-10vs with 4-20ma. [30]

Complementary

Product compatibility	Vista
Former part number	006902361
Material	PA (polyamide) housing Bronze protective filter
Analogue output type	0...10 V 4...20 mA
Current consumption	10 mA
Time constant	0...< 15 s
Temperature probe type	NTC 1800 Ohm 25 °C NTC 10000 Ohm 25 °C
Product weight	0.13 kg
Width	58 mm
Height	64 mm
Depth	35 mm

Environment

IP degree of protection	IP65
Ambient air temperature for operation	-10...60 °C
Ambient air temperature for storage	-40...60 °C
Standards	EN 50081-1 EN 50082-1



AM2315 - Encased I2C Temperature/Humidity Sensor

AM2315 Sensor runs on an I2C-interface This sensor measures two things temperature & humidity made safe in a nice weatherproof enclosed containing a small microcontroller that is able to provide a simple I2C interface. Running on a low 3.5v to 5.5v with a 10 mA max current works with 0-100% humidity.[31]

Technical Details

- 3.5 to 5.5V power and I/O
- 10 mA max current use during conversion (while requesting data)
- Good for 0-100% humidity readings with 2% accuracy
- Good for -20 to 80°C temperature readings $\pm 0.1^{\circ}\text{C}$ typical accuracy
- 0.5 Hz update rate
- Body size 98mm x 16mm diameter (4" x 0.9")
- 4 wires 20 inches long
- Weight: 82.64g
- This board/chip uses I2C 7-bit address 05C.



ANDARFT/R-X/S

This sensor can measure humidity/temperature in the outdoors. The output signal of 0-10V/4-20 mA passive temperature sensor can be connected. Operating power of 12-35vs and 20mA this sensor is designed for long-term stability and use giving two analogue outputs and casing degree of ip65. Resolution time of 8s[32]

Power supply:	12 ... 34 VAC/VDC
Sensor element (humidity):	Capacitive sensor
Sensor element (temperature):	Capacitive sensor
Sensor element temperature passive (opt):	At customer's option
Measuring range humidity:	0...100% r.H.
Output Humidity:	0...10V or 4...20mA
Tolerance Humidity 35% ... 70% r.h.:	± 2% (25...90% r.H.)
Measuring ranges temperature:	-30 °C ... +70 °C
Active output signal temperature	0...10V or 4...20mA
Temperature tolerance:	± 0.5K
Load at analogue 0-10 V output:	10...100 kOhm
Analogue output burden (4 ... 20 mA):	300...1000 Ohm
Operating temperature:	-30°C ... +70°C
Operating range:	0...98% r. H.
Response time (r.h.):	8 Sec. (63% at condensation)
Protection sleeve:	12 x 75 mm stainless steel
Connection:	Screw clamps 1,5 mm²
Housing:	PA6, Colour RAL 9011
Measurements housing:	75 x 69 x 44 mm
Protection class:	IP65
Sensor protection:	Sintered filter, HD polyethylene



LOXONE OUTSIDE TEMPERATURE & HUMIDITY SENSOR

Part. No.: 200031

This was the chosen for the portable weather system in this Report

The LOXONE OUTSIDE TEMPERATURE & HUMIDITY SENSOR is the ideal products for reading temperature and humidity outside. This is the lowest power sensor reviewed 15v. Having the two sensors in one product Saves a lot of power usage combined with an ip65 and resolution rate of 1 seconds making it the fast response time in the sections too. Measuring -30-+70°C and 0-100% humidity it covers all the need specifications

This sensor was chosen as it was able to combine TEMPERATURE & HUMIDITY SENSOR this help a lot with and with power consuming all contained in an ip65 casing working on 15v was perfect for the project it was able to work in all environment too with a measuring temperature range of -30to+70°C and humidity of 0-100%



Humidity	
Measurement range	0 ... 100% r.h.
Accuracy	+/- 2% r.h. (between 10% ... 90% r.h.)
Sensor element	Combined (humidity and temp)
Temperature	
Measurement range	-30°C ... +70°C
Accuracy	+/- 0,3°K (between 0°C ... +60°C)
General	
CE conformity	89/336/EWG
EMC emissions	EN 61000-6-3:2001
Sensor dimensions	See dimensions
Enclosure material	Polymide GK30
Connection	Screw terminals 1,5mm²
Filter	Sintered polyethylene 40µm
Operating voltage	15-36 VDC / 24 VAC
Surge protection	Varistor
Operating temperature	-30°C ... +70°C
Protection class	IP65

Wind speed sensor

Anemometer Wind Speed Sensor w/Analog Voltage Output

PRODUCT ID: 1733

This anemometer Wind speed sensor is used in common weather station with a well-made anemometer is designed allowing it to survive in outdoor environments Giving a variable Analog voltage of 0.4v for (0 m/s wind) and 2.0V (for 32.4m/s wind speed).

With a power supply of 7-24VDC. With a fast Resolution speed of 0.1ms.[33]

Specifications

- Output: 0.4V to 2V
- Testing Range: 0.5m/s to 50m/s
- Start wind speed: 0.2 m/s
- Resolution: 0.1m/s
- Accuracy: Worst case 1 meter/s
- Max Wind Speed: 70m/s
- Connector details: Pin 1 - Power (brown wire), Pin 2 - Ground (black wire), Pin 3 - Signal (blue wire), Pin 4 not connected



Wind Observer II Wind Speed Sensor

This Wind Observer II is a solid-state ultrasonic anemometer this device will provide wind speed and direction data via 1digital outputs. This also contains optional analogue outputs all contained in an IP66 rated stainless steel housing being able to provide high wind speed measurement range with a built-in de-icing mode for working at high altitude or at sea.[34]

WIND SPEED

Range	0 - 65 m/s (0-145mph)
Starting threshold	0.01 m/s
Accuracy	±2% @12 m/s
Resolution	0.01 m/s
Offset	±0.01 m/s

WIND DIRECTION

Range	0 - 359°
Dead band direction	None
Accuracy	±2° @12 m/s
Resolution	1°

MEASUREMENT

Ultrasonic output rate	1Hz, 2Hz, 4Hz, 5Hz, 8Hz or 10Hz
Parameters	UV, Polar, NMEA, Tunnel
Units	m/s, knots, mph, kph, ft/min
Average (Selectable)	Rolling average - 1, 2, 10 min, Gust - 3s
Block average	0-3600s

DIGITAL OUTPUT

Communication	RS422/RS485 full duplex/half duplex
Baud rates	1200, 2400, 4800, 9600, 19200, 38400
Formats	8 bit data; odd, even or no parity
Anemometer status	Supplied as part of standard message

POWER REQUIREMENT

Anemometer only	9-30 VDC (40mA @12 VDC)
Heating (optional)	3A @24 VAC or DC

SONIC TEMPERATURE

Range	-40°C to +70°C
-------	----------------

ANALOGUE OUTPUT - OPTIONAL

Quantity	3 (Speed, direction, status or sonic temp)
Scale	Multiples of ±10 m/s up to ±70 m/s
Type	±2.5V, 0-5V or 4-20mA
V output resistance	60 Ohms
4-20mA loading	10-300 Ohms

MECHANICAL

External Construction	Stainless steel 316
Size	381mm x 213mm
Weight	1.4kg

ENVIRONMENTAL

Protection Class	IP66 (NEMA4X)
Humidity	< 5% to 100% RH
Operating Temperature	-55°C to +70°C (Heated option)
Precipitation	300mm/hr
EMC	EN 60945:2002, EN 61326-1:2013
Icing	MILSTD883C Method 521.2 Procedure I

APPROVALS

Standards	Traceable to national standards Lloyds Register type approval
Site Calibration	None required. Integrity check unit (Zero wind) supplied as optional extra

ACCESSORIES

Pipe Mount	Contact Gill
WindView Software	Display/logging software



Anemometer - Wind speed sensor Model 100001

The anemometer has a hard aluminium body with many different power modes ranging from 5v to 24v. With two different output options of TTL or RS485 with a response time of 1m/s = 10 pulses with a measurement range of 0 to 50 m/s wind speed. -20 to +50 degrees (°C) working conditions. This also comes with a KOMAXIT® surface coating that protects from the chemical.[35]

Basic parameters:

the optical revolution sensor

Powered by a 5, 12 or 24 VDC

Outputs: TTL or RS485

Constant 1m/s = 10 pulses

Linearity up to 30 m/s, accuracy ±2%

Mounting into a tube of a 25-mm (1") diameter

Measurement range: 0 to 50 m/s

Temperature range: -20 to +50 degrees centigrade (°C)

Connected through a 2WK18279 connector (part of the package)

Height: 165 mm

Cross diameter: 120 mm

Weight: 200g

duraluminium (hard-aluminium) case, KOMAXIT® surface coating, stainless-steel shaft bearings

SONIC-ANEMO-DVC Ultrasonic Wind Speed Sensor

This conventional Wind sensor has no moving parts to advise because errors allowing for more accurate results.

With a big range of operations with a power supply of 2.7v to 35v with fast response rates with a rugged outer case of IP65. Provides results after start up instantly allowing for the transmissions of data with analogue output options with also instant transmissions of data.



Output data format	WA: 25KΩ, 5V max; WS: Pulse open collector 10 mA max
Information transmitted	Instant. W. Speed, Instant. W. Angle
Output rate	2 Hz / 30 Hz measurement
Wind module sensitivity	0.12 m/s
Wind module resolution	0.05 m/s (16 bits)
Wind module dynamic	0.12 to 40 m/s
Direction sensitivity	+/-1.5 °
Direction resolution	1 ° (9 bits)
Power supply	2.7 V to 35 V DC
Electrical consumption	2.6 mA Avg. @ 12 V
Op. temp. without icing	-15 °C to +55 °C
Cable	5 m / UV proof
Connection	RJ11, 2 wires Power Supply
Weight of the head	
Weight of unit assembly	200 gr with mounting part
Mounting	Vertical 300 aluminium arm Ø 16 mm



Wind direction sensor

Pulse Output/4~20mA/ 0~5V/0-10V Wind Direction Sensor Wind Speed Sensor Anemometer

Model Number: CSS-HS [36]

The CSS-HS Wind direction sensor is a high-performance wind direction sensor auto-heated de-icing capabilities with built-in strong anti-radio, anti-electromagnetic interference and anti-lightning surge protection these stop damage to the circuitry With an operating power supply of 12V-24V. With many different analogue voltage signs, outputs to choose from this allows for easy integration of the wind sensor.

Output type	Current output	Voltage output	RS485
Range	16 directions or 8 directions (0-360 degrees)		
Power supply	DC12V~24 V		
Signal output	4-20mA (three wires)	0.4-2V or 0-2V 1-5V or 0-5V	MODBUS protocol
Load capacity	$\leq 500\Omega$	$\geq 2K\Omega$	
Working environment	-20°C~+55°C, relative moisture 35-85% NA		
Start wind speed	$\geq 0.8\text{m/s}$		
Overall consumption (DC24V)	$\leq 700\text{mW}$	$\leq 300\text{mW}$	$\leq 300\text{mW}$
Weight	$\leq 0.5\text{Kg}$		

China Smart Sensor



sensor-carrie-control@hotmail.com

05103 Wind Monitor

The 05103 Wind Monitor has a UV-stabilized thermoplastic casing this stops resists corrosion from sea air environments and atmospheric pollutants. This wind monitor gives a reading of wind speed and wind direction with a wind direction range of 0-360° with a $\pm 0.3^\circ$. Wind speed range of 0 to 223mph with a ± 0.3 . All output signals for this device are analogue. [37]

Specifications

Operating Temperature Range	-50° to +50°C (assuming non-icing conditions)
Mounting Pipe Description	> 34 mm (1.34 in.) OD > Standard 1.0-in. IPS schedule 40
Housing Diameter	5 cm (2.0 in.)
Propeller Diameter	18 cm (7.1 in.)
Height	37 cm (14.6 in.)
Length	55 cm (21.7 in.)
Weight	1.5 kg (3.2 lb)
Wind Speed	
Range	0 to 100 m/s (0 to 224 mph)
Accuracy	± 0.3 m/s (0.8 mph) or 1% of reading
Starting Threshold	1.0 m/s (2.2 mph)
Distance Constant	2.7 m (8.9 ft) 63% recovery
Output	ac voltage (three pulses per revolution) 90 Hz (1800 rpm) = 8.8 m/s (19.7 mph)
Resolution	(0.0980 m s ⁻¹)/(scan rate in seconds) or (0.2192 mph)/(scan rate seconds)

Wind Direction	
Mechanical Range	0 to 360°
Electrical Range	355° (5° open)
Accuracy	$\pm 3^\circ$
Starting Threshold	1.1 m/s (2.4 mph) at 10° displacement
Distance Constant	1.3 m (4.3 ft) 50% recovery
Damping Ratio	0.3
Damped Natural Wavelength	7.4 m (24.3 ft)
Undamped Natural Wavelength	7.2 m (23.6 ft)
Output	> Analog dc voltage from potentiometer (resistance 10 kohm) > Linearity is 0.25% > Life expectancy is 50 million revolutions.
Voltage	Power switched excitation voltage supplied by datalogger



81000 R.M. Young Ultrasonic AnemometerThe 81000 R.M Young UltraSonic Anemometer Has a durable corrosion-resistant casing. With 3 opposing pairs of ultrasonic transducers. The available output is RS-232 and RS-485 outputs or four voltage output channels. With a wind speed measurement of 0 – 90mph and resolution of 0.01ms wind direction of 0-360 degrees with a resolution of 0.1 and tempura reading of -50 to +50°C.

8100 RM Young Anemometer Specifications

Wind Speed: 0 to 40 m/s (0 to 90 mph)

Resolution: 0.01 m/s

Threshold: 0.01 m/s

Accuracy: $\pm 1\%$ ± 0.05 m/s (30 m/s), $\pm 3\%$ (40 m/s)

Wind Direction: 0 to 360 degrees

Elevation Range: ± 60 degrees

Resolution: 0.1 degree

Accuracy:

± 2 degrees (30 m/s), ± 5 degrees (40 m/s)

Speed of Sound: 300 to 360 m/s

Resolution: 0.01 m/s

Accuracy: $\pm 0.1\%$ ± 0.05 m/s (30 m/s)

Sonic Temperature: -50 to +50 °C

Resolution: 0.01 m/s

Accuracy: $\pm 2\%$ °C (30 m/s)

Serial Output: User Programmable ASCII, RS-232 or RS-485

1200 to 38400 baud

4 to 32 Hz (user-selected)

Units: m/s, cm/s, mph, knots, km/h

Analog Voltage Outputs:

4 voltage outputs, 0 to 5000 mV

Power Requirement: 12 to 24 VDC, 110 mA

Operating Temperature: -50 to +50 °C

Ultrasonic Wind Speed Sensor Dimensions:

56cm high x 17cm radius (3 support arms)

Weight: 1.2 kg (2.6 lb)

Shipping Weight: 4.5 kg (10 lb)



Wind Sonic Ultrasonic Anemometer

This was the chosen for the portable weather system in this Report

The Gill WindSonic is a robust, lightweight device with an ip66 casing protection with no moving parts Wind sensor is a very robust, lightweight unit with no moving parts, allowing for results Of wind speed and direction this device allows the units of wind speed and voltages to be changed. De- signed for use in, data logger with many different outputs such as Rs232,rs422,rs486 and analogue

Wind speed range of 0-60ms and wind direction range of 0-359 degrees.

Both with a resolution speed 0.01ms. Operating voltages 5-30vs

This sensor was chosen as it was able to give all the results need in an anlage format decreased the need for a max chip to convert the rs232 from 10v to 5v this device can work in all environment from -35to70°C it even has a de-icing mode that can be used in very bad environments [36]

Output	Units of measure	Metres/second (m/s), Knots, Miles per hour (mph), Kilometres per hour (kph), Feet per minute (fpm)	Environmental	Moisture protection	IP66
Output frequency	0.25, 0.5, 1, 2, or 4 outputs per second	Digital	Temperature	Operating -35°C to +70°C Storage -40°C to +80°C	
Parameters	Polar - Speed and Direction UV - 2 axis, signed Speed NMEA Speed and Direction Tunnel - U speed & U Polarity	Analogue Polar - Speed and Direction UV - U Speed and U Polarity NMEA - Speed and Direction Tunnel - U Speed & U Polarity	Humidity	Operating <5% to 100%	
Wind Speed	0 – 60m/s,	0 – 5m/s, 0 – 10m/s, 0 – 20m/s, 0 – 30m/s, 0–40m/s, 0 – 50m/s, 0 – 60m/s	EMC	EN 61326	
Accuracy	$\pm 2\%$ (at 12m/s)	$\pm 2\%$ (at 12m/s)	Standards	Manufactured within ISO9001: 2008 quality system	
Resolution	0.01 m/s	10 bits	Power requirement	5 – 30 V DC Option 1 and 2 units. 7 – 30 V DC. Option 3 units. Current drain depends on variant i.e. RS232 approximately 9mA rising to 44mA for Analogue variant. Lowest power consumption is obtained with the following configuration: - M2, P20, B3, S9 (approximately 5.5mA at 12v).	
Wind Direction	0 - 359°	0 - 359° Or 0 - 539° (Wraparound mode)	Mechanical	Size / weight	142mm diameter x 163mm 0.5kg
Accuracy	$\pm 2^\circ$ (at 12m/s)	$\pm 2^\circ$ (at 12m/s)	Mounting	Pipe mounting 1.75 inches (44.45mm) diameter	
Resolution	1°	1°	Material	External - Acrylate Styrene Acrylonitrile, Polycarbonate blend	
Analogue output formats	0-5V 4-20mA 0-20mA	$\pm 1\%$ of full scale N.B. Analogue output impedance = 1K Ω (V out) Load resistance between the Analogue outputs (Pins 8 & 9) and Signal Ground (Pin 1) must be ≥ 300 ohms, including cable resistance.			
Digital output formats	Gill Marine – NMEA	Continuous or Polled (output on request by host system) Polar (Speed and Direction) or UV (2 axis, signed Speed) NMEA 0183 version 3			
Communication formats	WindSonic Option 1 WindSonic Option 2 WindSonic Option 3 Baud Rate	RS232 RS232, RS422, RS485 (2 wire Point to Point) RS232, RS422, RS485 (2 wire Point to Point), and Analogue 2400, 4800, 9600, 19200, 38400 Baud Rates			
Anemometer status:	Status OK and Error codes included in output message				



Airborne particle count sensor

PMS1003 Sensor

The pms1003 sensor is an of the digital and universal particle counter. This obtains results of suspended partials in the air. These results are shown in a digital output with a measurement range of 0.3 to 10 Micrometres this relays results in <1second for a single response to <10seconds for the total response results. This device is designed to improve air quality by giving correct concentration data in time of particle [37]

Technical Index

Parameter	Index	unit
Range of measurement	0.3~1.0; 1.0~2.5; 2.5~10	Micrometer (μ m)
Counting Efficiency	50%@0.3μ m 98%@>=0.5μ m	
Effective Range (PM2.5 standard)	0~500	μ g/m ³
Maximum Range (PM2.5 standard) *	≥1000	μ g/m ³
Resolution	1	μ g/m ³
Maximum Consistency Error (PM2.5 standard data)*	±10%@100~500μ g/m ³ ±10μ g/m ³ @0~100μ g/m ³	
Standard Volume	0.1	Litre (L)
Single Response Time	<1	Second (s)
Total Response Time	≤10	Second (s)
DC Power Supply	Typ:5.0 Min:4.5 Max: 5.5	Volt (V)



S-PM-N01-2 Air Quality Monitor

RS-PM-N01-2 is an industrial Air Quality Monitor Transmitting concentration particle results by using laser scattering measurement through a unique frequency acquisition technology it is able to screen the air being able to measure the equivalent particle size and a number of particles the unit volume is calculated by the unique algorithm able to work out the volume. This ability to work in the outdoor environment with an ip65 able to measure all ranges of PM2.5 or PM10.[38]



DC power supply (default)		10 ~ 30V DC
Maximum power consumption.	Current output	1.2W
	Voltage output	1.2W
Resolution	0.1ug / m3	
Transmitter circuit operating temperature	-20 °C ~ +60 °C. 0% RH ~ 80% RH	
Measuring range	PM2.5	0 ~ 6000ug / m3
	PM10	0 ~ 6000ug / m3
Response speed	≤ 90S	
Warm-up time	≤2min	
Output signal	current output	4 ~ 20mA
	Voltage output	0~5V/0~10V
load capacity	Voltage output	Output resistance ≤250Ω
	Current output	≤600Ω

Winsen particle counter sensor

The Winsen particle counter is a particle counter sensor and a dust particle sensor used mostly for a portable instrument that needs to measure air quality and gases this is able to take measurements from pm1.0 to pm10. Running on an operating voltage of 4.5v-5.5v this is quite low compared to another particle counter. All output from this device is UART 3v TTL this perfect for small microcontrollers.[39]



Technical Parameters	
Model	ZH03A
Detection Gas	PM1.0, PM2.5, PM10
Output	UART OUTPUT (3V TTL)
	DAC (0~2V is corresponding to 0-1000)
Working Voltage	4.5V-5.5V
	Working Current
Dormancy current	8mA
Response Time	<90s
Working Humidity	15%RH-80%RH(no condensation)
Storage Temperature	-20~40°C
Life Span	3 years (in air)
Dimension	50*32.4*21mm
PIN1	Vin (Voltage Input 4.5V~5.5V)
PIN2	GND
PIN3	SET pin
PIN4	RXD Serial receive pin
PIN5	TXD Serial send pin
PIN6	RESET pin
PIN7	DAC Analog output
PIN8	PWM output

OPC-N2

This was the chosen sensor for the probable weather system

OPC-N2 is able to measures PM1, PM2.5 and PM10 supplying sensors results for air quality networks this able to increased awareness of the health danger from particulates. This is able to measure both gas and VOC for indoors and outdoors air quality monitoring able to measures particles from 0.38 micron to 17-micron diameter accurately minimal maintenance using is pumpless design with an onboard data logging via 16GB SD having a sampling rate of 1 to 30 seconds. Powered with 4.8 to 5.2v with a typical 175mA or with laser and fan off it is able to go down to 95mA. With an output of SPI real-time data communication, this also allows for power control by turning fan and laser off when not in use.

This was chosen as it has a low power consumption of only 95mA when laser and fan are off being able to turn these things are vital when working over a week period as you don't want to be measuring all the time so saving can help the product be used for longer. Giving it data in real time SPI was a pulse for this product and have the option to ad Sd card to the Device could save over space as it could save it results to itself.[40]

MEASUREMENT		
Particle range	Spherical equivalent size (based on RI of 1.5)	0.38 to 17
Size categorisation	Number of software bins	16
Sampling interval	Histogram period (seconds)	1 to 30
Total flow rate (typical)	L/min	1.2
Sample flow rate (typical)	mL/min	220
Max particle count rate	Particles/second	10,000
Max coincidence probability	%concentration at 10 ⁶ particles/L	0.84
	%concentration at 500 particles/L	0.24
POWER		
Measurement mode	mA (typical)	175
Laser on, fan off	mA (typical)	95
Voltage range	VDC	4.8 to 5.2
Switch-on transient	mW for 1ms	< 5000
DATA		
Digital interface/connections	SPI (real-time data and communications)	
Data storage	Micro USB (firmware updates and standalone mode)	
	micro-SD (.CSV format) (GB)	16
KEY SPECIFICATIONS		
Digital interface	SPI (Mode 1), USB	Class 1
Laser classification	as enclosed housing	
Temperature range	°C	-10 to 50
Humidity range	% rh (continuous)	0 to 99 (non-condensing)
Weight	g	< 105

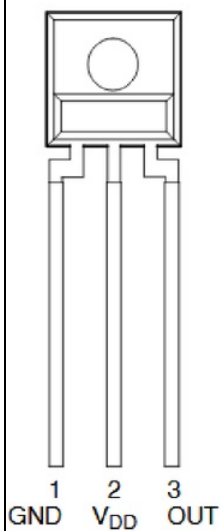


Sunlight Brightness sensor

Light Dependent Resistor TSL235R

One way of measuring sunlight Brightness is using a Light Dependent Resistor (LDR) also known as photoresistor this is cos the sensor gives a variation of resistance correlating with the amount of light falling on it. This sensor would have been one of the cheapest ways to measure brightness with a price of [€4.89 \(\\$5.48\) for 20 pieces.](#)

The TSL235R reacts to light and converts it to a frequency this has a photodiode and a current-to-frequency converter to be able to give a digital output this helps when connecting it to a microcontroller the output of the sensor is Output is a square wave. Responds over the light range of 320 nm to 1050 nm with a working range temperature range of -25°C to 70°C .[\[41\]](#)



Product Facts

Supply Voltage [V]	2,7-5,5
Responsivity [Hz/uW/cm ²]	625 @ 635
Output Frequency [Max.]	500 KHz
Selectable Sensitivity and Full-scale Output Frequency	
Output Frequency Tolerances [+/- %]	20
Temperature Range [°C]	-25 to 70
Packages	S
Remark	

Compare All



Light sensor LDR1 for Millenium 3

The LDR1 is an analogue output sensor with no converter I work like the TSL235R but has none of the digital capabilities. Used mainly in lighting management and energy saving with a 10-bit analogue input resolution 0-10vs and a Building management system. With a built-in Compact Controller and an Expandable Controller.[\[42\]](#)

Specifications

General characteristics

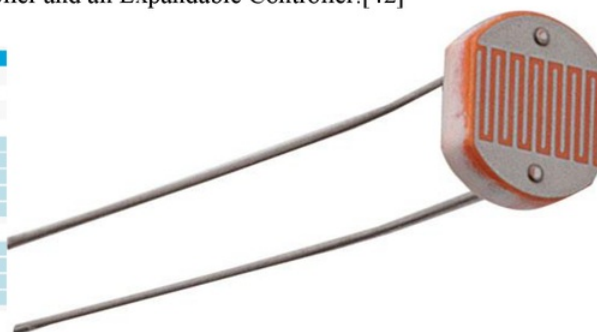
Environmental characteristics

Accuracy	< 10 % of full scale
Peak spectral response	600 ±20 nm
Drift Temperature (%/°C)	0.5 %/°C
Operating temperature	-20 ... +70 °C
Storage temperature	-20 ... +100 °C

Mechanical characteristics

Cable length	3000 mm
Protection rating	IP64
Mounting by screw	Ø 5 mm
Mounting	Hole Ø 10 mm, thickness 9 mm max.

PHOT ASGARD 24K1E



The PHOTASGARD is an intensity sensor with four switchable measuring ranges all able to luminous intensity used in a wide range of conditions from industrial halls to greenhouses contain a light intensity or twilight sensor ranging from 350 nm to 820 nm. With an operating voltage of 24v ac/dc with a current drain of 10mA with an output voltage of 0-10v and 2-20mA working at an ambient temperature of -10 to +50°C. Enclosed in an ip65 casing with a plastic structure.[43]



TECHNICAL DATA:	
Power supply:	24V AC/DC, current consumption max. 10mA at 24V DC
Sensor:	photodiode with glass case (see beginning of this chapter)
Measuring ranges:	0-500 Lux / 1 kLux / 20 kLux / 80 kLux, multi-range switching (via DIP switches) see schematic diagram (other individual ranges optional, arbitrarily selectable, e.g. 100 kLux)
Output:	4-20mA (active) or 0-10V (linearised)
Ambient temperature:	-10...+50°C
Electrical connection:	0.14 - 1.5 mm ² , via terminal screws on circuit board
Measuring error:	< ± 10% of final value
Temperature drift:	< ± 5% of final value / 10K
Enclosure:	plastic, material polyamide, 30% glass-globe-reinforced, with quick-locking screws, colour pure white (similar RAL9010)
Dimensions:	72 x 64 x 39.4 mm
Installation:	on-wall
Cable gland:	M16, including strain relief
Protection class:	III (according to EN 60730)
Protection type:	IP 65 (according to EN 60529)
Standards:	CE conformity, electromagnetic compatibility according to EN 61325+A1+A2, EMC directive 2004/108/EC

MTN663593 *Brightness sensor*

This was the chosen sensor for the probable weather system

MTN663593 brightness sensor is An industry stranded Sensor with a strong casing of IP65 providing all the defence need to working the Outdoor environment designed for long time use and minimum maintenance. All contained in a small compact size package with a measuring range of 0-60 Klux, linear with a low power consumption of 5mA at 24v with an output of 0-10v.

This device was chosen as it has the lowest power consumption of 5mA and has a large measuring range of 0 to 60klux all combined with an ip65 casing and working temperature of -30to+70°C[44]

Technical data

Supply voltage:	DC 24 V (DC 15–30 V)
Output:	DC 0–10 V (mind. 1 kΩ load, short-circuit proof)
Connecting terminals:	Screw terminals, max. 2.5 mm ²
Ambient temperature:	-30 to +70 °C
Type of protection:	IP 65
Incoming cable:	through M12 screw fitting
Recommended cable:	3 x 0.25 mm ²
Cable length:	max. 100 m
Mounting position:	any, recommendation: M12 screw fitting at the bottom
Fixing method:	Screw fixing
Dimensions:	64x58x35 mm
Weight:	approx. 0,2 kg



Brightness sensor

Measuring range:	0–60 kLux, linear
Power consumption:	approx. 5 mA

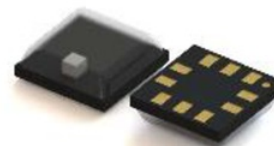
UV levels sensor

Digital UV index sensor

This digital UV index sensor is able to provide an accurate measurement of the ultra-violet radiation to be taken from sunlight ASIC is able to provide the UV index data through I²C and SPI interfaces this means no algorithm to calculate all is done on the UVIS25 on board. A temperature range extending from -20 °C to +85 °C. A UV index range output of 0-15UV with a low power supply need of 1.7to 3.6v needed. [45]

Features

- 0 - 15 UV index output range
- Resolution: UVI/16
- Active and power down modes
- Continuous reading at 1 Hz ODR / one shot mode
- Interrupt functions: Data Ready and UVI thresholds
- SPI and I²C interfaces
- Supply voltage: 1.7 to 3.6 V
- ECOPACK[®] lead-free compliant



LGA-10L

GUVB-S11SC-3LWH3

This UV sensor gives out an Analog Voltage Output to show the UV radiation with a single supply voltage and an ability to measure all the need UV Index from Sunlight with a response time of 10ms and spectral detection range of 290 to 400 nm. With a larger the usual 9-24v dc supply voltage need for the UV sensor,

[46]



UV Sensor Probe GUVB-S11SC-3LWH3 Absolute Maximum Ratings

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Storage Temperature	T _{st}	-40		90	°C	
Operating Temperature	T _{op}	-30		85	°C	

UV Sensor Probe GUVB-S11SC-3LWH3 Electro-Optical Characteristics (at 25 °C)

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Supply Voltage	V _{cc}	9		24	V	DC
		1.8		5.5	V	Low Power (Option)
Supply Current	I _q		3.3		mA	
Spectral Detection Range	λ	290		400	nm	10% of Max
Output Voltage	V _{out}		0.25		V	at 1 UVI
Response Time	T		10		ms	

UV Sensor Probe - GUVx-T1xGC-3LO1

The GUVx-T1xGC-3LO1 is a UV sensor probe able to work in High-Temperature Environment this allows this sensor to be used in places such as deserts or other high High-Temperature Environment it achieves this by using fibre optical cable.

With a single supply voltage and an analogue voltage output is able to run on a 9-24v operating voltage with an output voltage of 0-5v[47]

UV Sensor Probe GUVx-T1xGC-3LO1 Case dimensions

LO Probe (mm)		LO Probe Material	Optical Fiber		
Diameter	Total		Length (m)	Core (mm)	Material
20	56	Al-60	1	1	SUS 304

UV Sensor Probe GUVx-T1xGC-3LO1 Absolute Maximum Ratings

Absolute Maximum Ratings		Min.	Typ.	Max.	Unit	Remark
Operating Temperature	Optical Fiber			200	°C	
	LO Probe	-30		85	°C	

Electro-Optical Characteristics (at 25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage	V _{cc}	9		24	VDC	
Supply Current	I _q		3.3		mA	
Detection Range	GUUV-T11GC-3LO1	λ	230	395	nm	10% of Max
	GUUV-T12GC-3LO1	λ	220	320	nm	
	GUUV-T11GC-3LO1	λ	220	280	nm	
Output Voltage	V _{out}	0		5	V	
Detection Power Range	P	0		100	mW/cm ²	
Response Time	T		10		ms	



Model SU-100

This was the chosen sensor for the probable weather system

This Ultraviolet (UV) radiation probe is able to work on spectrum from 100 to 400 nm this is then subdivided into three wavelength ranges : UV-A (315 to 400 nm), UV-B (280 to 315 nm) and UV-C (100 to 280 nm) there are used as energy flux units of watts per square meter. Now power supply is need for this product as it has a outputs an analogue voltage that is directly proportional to UV radiation incident on a planar surface all kept safe in an aluminium housing

This was chosen as this product does not consume any power at all this product this was best for the project saving on power and giving accrete results of all UV bands form A-C was a factor as not all have such a large band range.[48]



SU-100	
Sensitivity	0.20 mV per $\mu\text{mol m}^{-2} \text{s}^{-1}$; 0.61 mV per W m^{-2}
Calibration Factor (reciprocal of sensitivity)	5.0 $\mu\text{mol m}^{-2} \text{s}^{-1}$ per mV; 1.65 W m^{-2} per mV
Calibration Uncertainty	$\pm 10\%$ (see Calibration Traceability below)
Measurement Repeatability	less than 1 %
Non-stability (Long-term Drift)	less than 3 % per year
Non-linearity	less than 1 % (up to 300 $\mu\text{mol m}^{-2} \text{s}^{-1}$)
Response Time	less than 1 ms
Field of View	180°
Spectral Range	250 nm to 400 nm (see Spectral Response below)
Directional (Cosine) Response	$\pm 10\%$ at 75° zenith angle
Temperature Response	Approximately 0.1 % per °C
Operating Environment	-40 to 70 °C; 0 to 100 % relative humidity
Dimension	24 mm diameter; 28 mm height
Mass	75 g (with 5 m of lead wire)
Cable	5 m of two conductor, shielded, twisted-pair wire; additional cable available in multiples of 5 m; santoprene rubber jacket (high water resistance, high UV stability, flexibility in cold conditions); pigtail lead wires

GPS position

GeoCube

The Geocube is a ruggedized GPS coupled with an RF device enabling communication. This sensor can withstand very harsh environments and consumes 500mw to 4mw when in sleep mode with an operating temperature range of -40 to 55°C and an IP protecting of ip67 with an operating voltage f 3.3v to 20v[49]

Parameter	Symbo l	Min	Typ.	Max	Unit
Ingress Protection Rating	IP		IP67		
Storage temperature range	STR	-40		80	°C
Shock resistance	IK		IK5		
Number GEOCubes in a network	NGN	2		50	
Supply voltage	VS	3.3	3.7	20	V

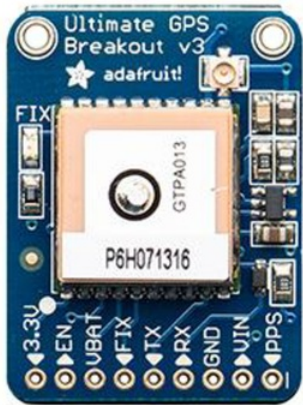
4 – OPERATING CONDITIONS

Parameter	Symbol	Min	Typ.	Max	Unit
Operating temperature range	OTR	-40		55	°C
Positional dilution of precision	PDOP			5	
Stability zone around each Geocube		5			m
Masks limit angle from ground				15	°
distance between geocubes				10	km



Adafruit Ultimate GPS Breakout - 66 Channel MTK3339

This high-sensitivity GPS that can track up to 22 satellites on 66 channels with a built-in antenna. It up data its location 10 times per second with high sensitivity logging or tracking and only consuming 20mA during navigation operating voltage of 3.3v.[50]



- Satellites: 22 tracking, 66 searching
- Patch antenna size: 15mm x 15mm x 4mm
- Update rate: 1 to 10 Hz
- Position accuracy: 1.8 meters
- Velocity accuracy: 0.1 meters/s
- Warm/cold start: 34 seconds
- Tracking sensitivity: -165 dBm
- Acquisition sensitivity: -145 dBm

A2035H - GPS Module, with Antenna, SiRFStar IV GPS Engine

This was the chosen sensor for the portable weather system

A2035H Is a has some leading performance over its counterparts the combination of the enhanced fully functional SiRFStar IV technology with high directional patch antenna built in. ultra-fast response time and being able to work in the demanding environmental conditions being able to use hibernation mode is vital on power consumption Lowing it to the only 23.6uA from a full power mode of 40mA. This low power consumption can save a load of the power of the over readings of a week. Operating on 3.0-3.6VDC and has a USART output connection.

This device was chosen for it low power operation mode and compact design. Other systems use too much power and did not contain a hibernation mode.[51]

COMMUNICATION

UART - NMEA (Default)	
NMEA message Switchable	GGA, RMC, GSA, GSV, VTG, GLL, ZDA
Baud rate Switchable	4,800 (default) 1,200 to *15.2k
Ports	Tx (NMEA output) Rx (NMEA input)
UART - SiRF Specific SSB/OSP	
SiRFBinary protocol	Protocol for SiRFstar product family up to SSIII
One Socket Protocol	Protocol extension for SiRFstarIV
Baud rate Switchable	57.6k (default) 1,200 to *15.2k
Ports	Tx (Binary output) Rx (Binary input)
SPI - NMEA/SiRF Specific	
Clock	Up to 6.8 MHz
Ports	DO (NMEA / Binary output) DI (NMEA / Binary input) SPI CLK (clock - input) SPI CS (chip select - input)

POWER

Input voltage	3.0 to 3.6 VDC Nominal 3.3 VDC
Average current draw	
Full power mode (searching)	40 mA (TBC)
Full power mode (tracking)	29 mA (TBC)
PTF mode	4.1 mA (TBC)
MPM / SiRFaware	40 µA (TBC)
Hibernate	23.5 µA (TBC)
Antenna supply via Vant	
Voltage range	up to 5.0V
Max. allowed current ¹⁾	50 mA

PERFORMANCE

Channels	48 parallel tracking
Correlators	400,000 plus
Frequency	L1 - 1.575 MHz
Sensitivity	
Tracking	- 163 dBm
Navigation	- 160 dBm
Acquisition (cold start)	- 148 dBm
Position Accuracy (horizontal)	< 2.5 m CEP (autonomous) < 2.0 m CEP SBAS
Time To First Fix	
Hot Start ¹⁾	< 1 s
Warm Start ²⁾	< 32 s
Cold Start ³⁾	< 35 s
Navigation	
Update Rate	1 Hz/ 5 Hz Supported



Battery

DEA DEA Rechargeable batteries for 24v operators

Rechargeable batteries for 24v operators, 12v - 1,3Ah complete with wiring cables

£62.00 from Arden Gate Automation[51]

Rechargeable Battery, 24 V, Nickel Metal Hydride, 3.3 Ah[53]

APC Smart-UPS 24V XL (SU24XLBP) 12V 18Ah UPS Battery[54]

Nimh Battery: 24V 20Ah (M cell) Rechargeable Battery Pack

This was the chosen sensor for the probable weather system

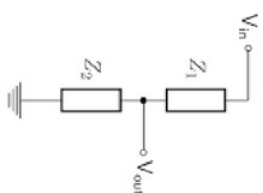
\$690.00[55]

Battery	24V 20Ah Nimh rechargeable battery pack is made of 20 pcs of M size 20Ah cells - Shrink wrap by heavy duty black PVC 65 °C thermostat for charging protection - Temperature sensor (BEC male plug) installed. - Must connect temperature sensor (BEC male plug) between battery charger (BEC Female Connector) and battery pack before charging to protect battery from overcharging or explode. We are not responsible for any damage caused by misuse.
Voltage	24V (working) , 28V (peak), 20V (minimum)
Capacity	20Ah (960Wh)
Terminal	Seperate Charging / Discharging Terminals: - Charge: 6" 18 AWG wires - Discharge: 6" 16 AWG wires
Max. Discharging Rate	60A
Dimensions (LxWxH)	 5x4 Side by Side: 214 mm (8.43 in) x 167 mm (6.5 in) x 95 mm (3.74 in) 10x2 Side by Side: 424 mm (16.7 in) x 95 mm (3.74 in) x 88 mm (3.46 in)
Weight	7025 grams (15LB 7.8oz)
Related Products	- Smart Charger: You can use our 19.2V-24V Nimh Smart Charger. - Need to DIY? please order connectors here.
Warning	- Please don't discharging the battery pack below 20V (1.0V/cell).Deep discharging may damage NiMH battery pack. - Charging battery immediately every time it is discharged. Never storage the battery pack at below 20V. - Please also read our safety warnings
Notes	Things to know about Nimh Batteries

Power calculation

To bring down some of the output voltages from some of the sensors potential divider was used

The output of most of a few of the sensor was 10V this need to be lowered down to 5v so it was accepted by the chip. So if the $V_{in}=10V/R1=10k/R2=10k$ and applied formal So $V_{out}=5V$

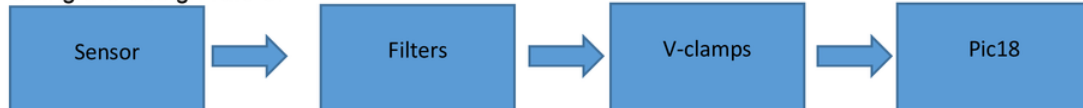


$$V_{out} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$$

Circuit design and a PCB design

After picking an appropriate Sensors and microcontroller for the portable weather system it was possible to start the design. Knowing that most of the sensors chosen to work of 15vs a 24v battery have been chosen this would reduce the size of the PCB as no step-up transformers would be needed. Using voltage regulators to step down the 24 to 3.3v and 5vs these power levels are needed to power such things as the Pic18f at 5v and SD card at 3.3v and other lower voltage sensors.

Using the design rule of



This helped with the design as high-quality sensors have been picked no filtering was need on this project this again lowered the needed components on the PCB.

After working out all the voltages and output signals of all sensors some sensors need to be stepped down in power so a voltage divider was used to keep all input to the pic18f lower than 5v otherwise risking an overload of the chip.

2 SPI connection is a need for the device so 1 comes on the pic18f another SPI ports will be created in programming for the OPC-n2 Particle counter.

With most of the Sensors That are connected to pic18f being over 5v, a voltage divider was used to being down a typical 10vout put down to 5vs by using two 10k resistors in series

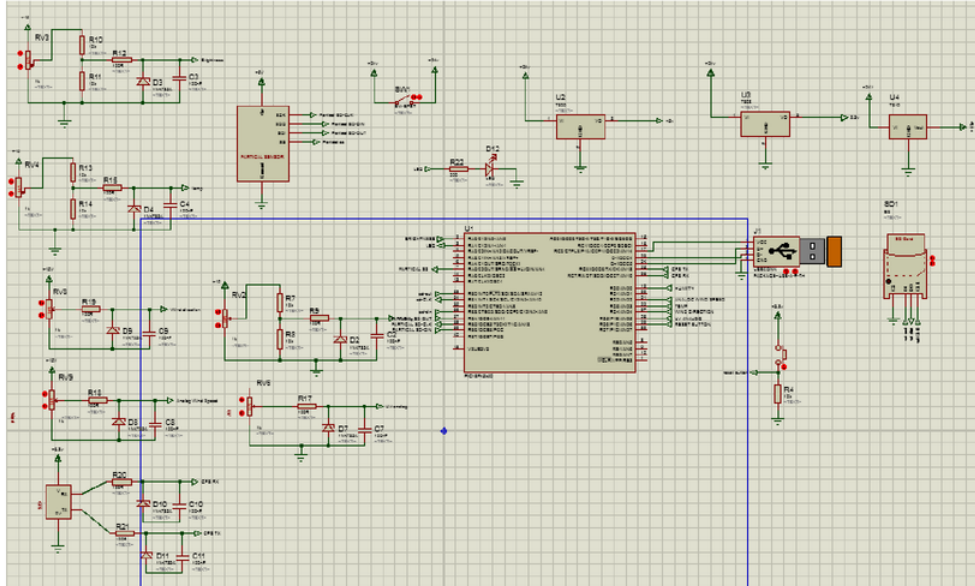
A reset Button has been added to this device to reset the Results and to start and stop the Device. By holding the button down for 10 seconds it will reset the device. Pressing will start and stop it.

A switch has been added to turn the device on and off the saves the battery life when not in use.

The GPS system worked on RS232 TTL5v So it could be directly connected to the Pic 18f with only Voltage clamps need to stop any overloading of the Chip. The GPS will also be able to go into hibernation when not in use only consuming 23.5uA so when not in use this will be used to save power.

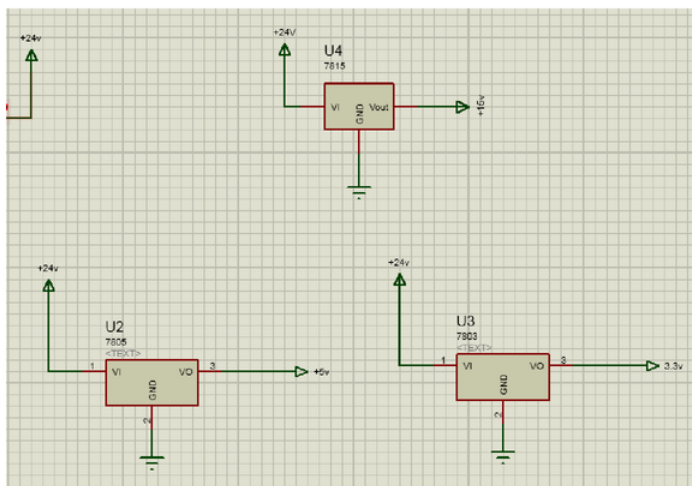
Full schematic

This show the final schematic on Proteus this will be broken down into section sensors, PIC, other (voltage regulators button, switch, LED, SD card connection and USB connection).



Voltage regulator

These are used to step down the 24v battery input to 15v,5v,3,3v these are archived by using 7803 for the 3,3v 7805 for the 5v and 7815 for the 15v

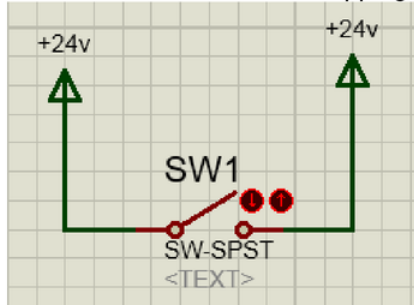


Button/Switch

There are 1 button and 1 switch on the product the Switch is used for turning the device off and on. There also a Reset Start/Stop button.

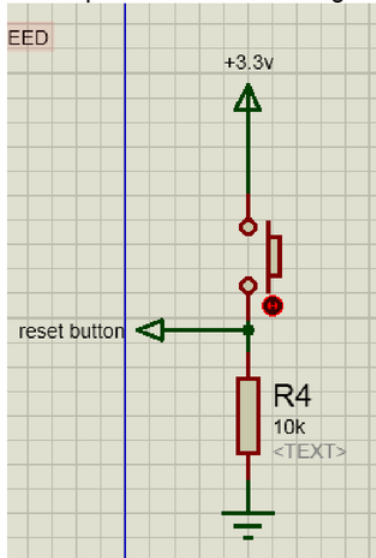
Switch

This makes a short circuit stopping the 24v from the battery.



Button

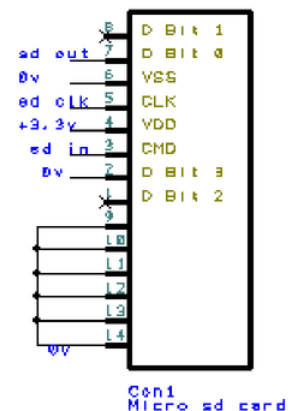
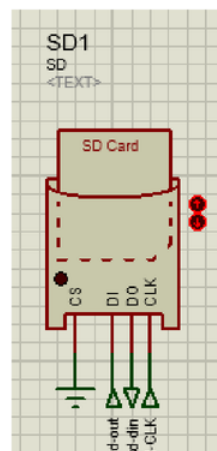
This a pull-down button using the 3.3v



SD card connection

The SD card requires a 3.3v operating voltage

The show both the connections need for Power and I/O ports.

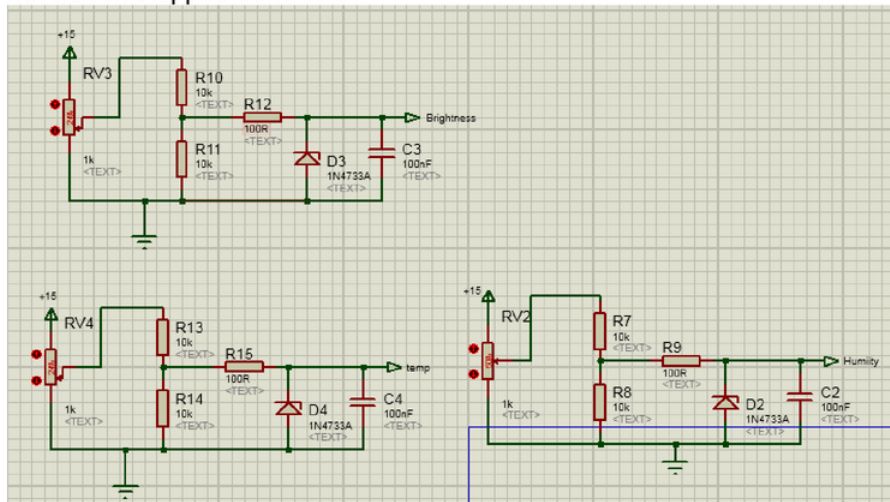


Sensors

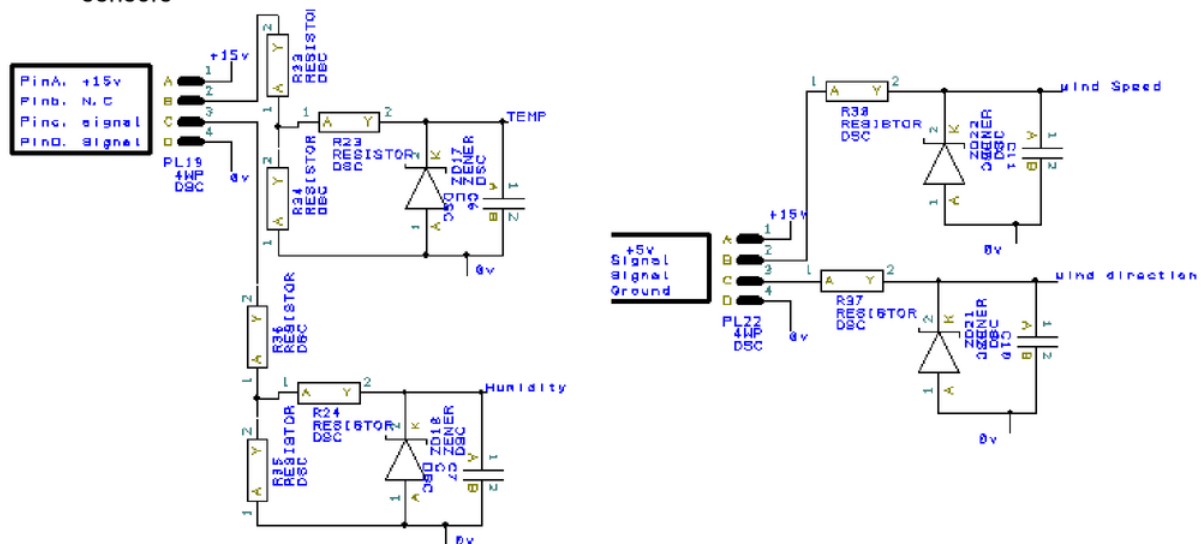
Brightness, Temp, Humidity,

With many sensors having different Requirement such as voltage or output voltages it was best to deal with each sensor individually. A group of the sensor would run on 15v that made thing a lot easier and give out analogue output. But things like GPS that run on rs232 was a little different the partial sensor was also not an analogue output it was an SPI output.

This show all the 15v input and 10v output sensor all these sensor output voltages have been stepped down to 5v.

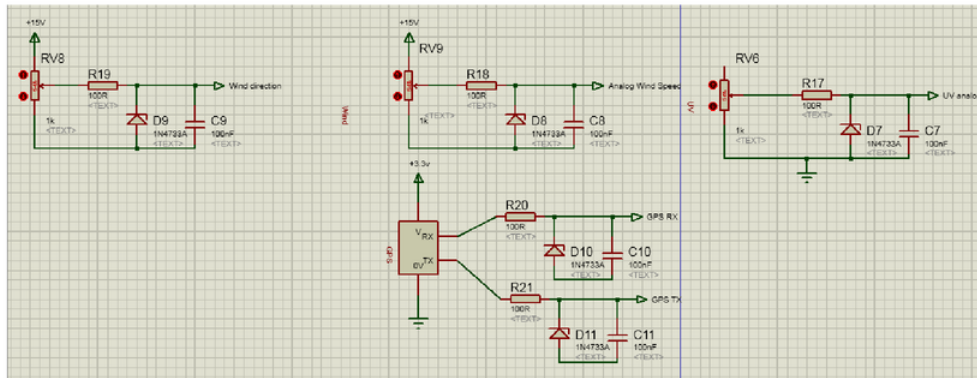


In the above diagram humidity and temp are disconnected from each other but both are one sensor give two results as shown here. This is also the same as the wind sensors



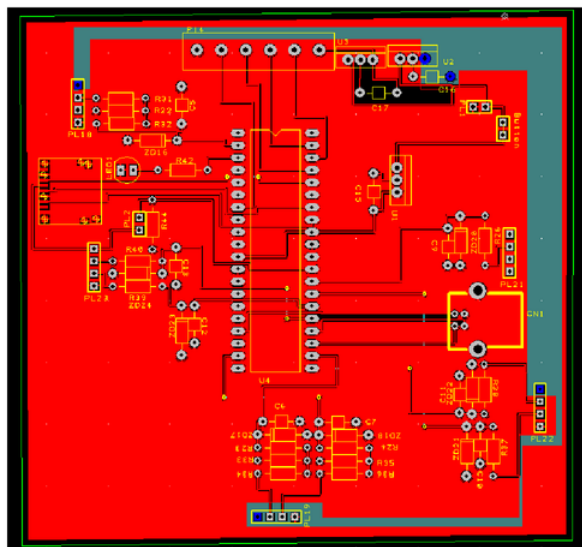
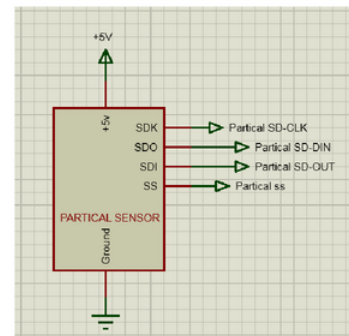
Wind, UV and GPS

The wind sensor has an input of 15v but gives out under 5v analogue signal.
 The UV sensor does not need any input voltage it's like a solar panel gives out its own voltage as a reading.
 The GPS needs 3.3v input and gives a rs232 output of TTL 5v.



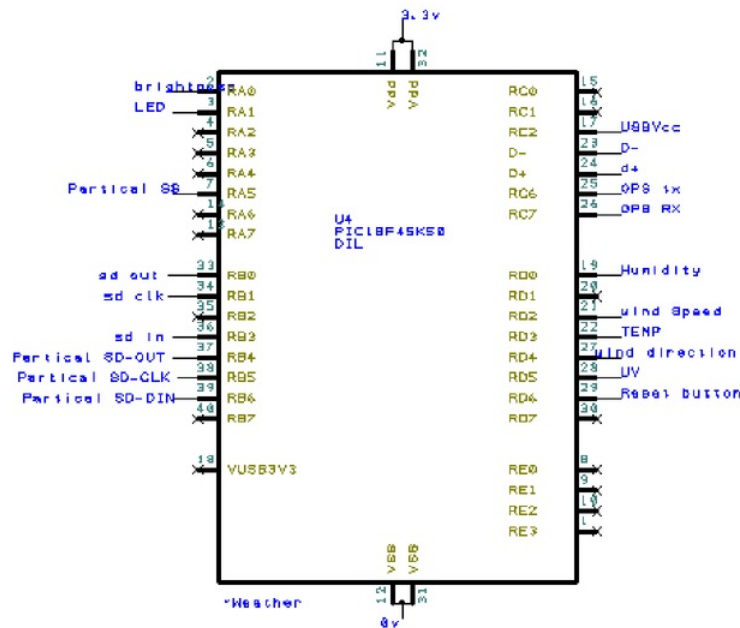
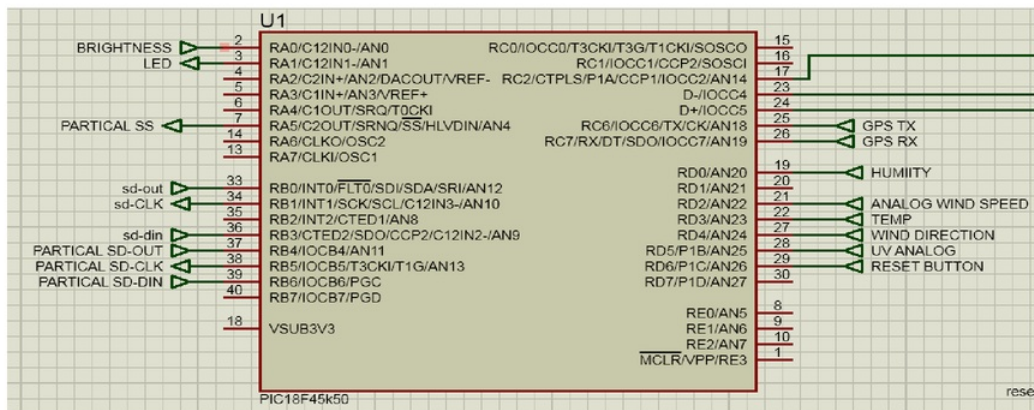
The partial sensor

The partial sensor need a 5v input but gives it reading in SPI one SPI port was already used for the SD card so One more SPI port will be made in programming.



PIC PIC18F45k50

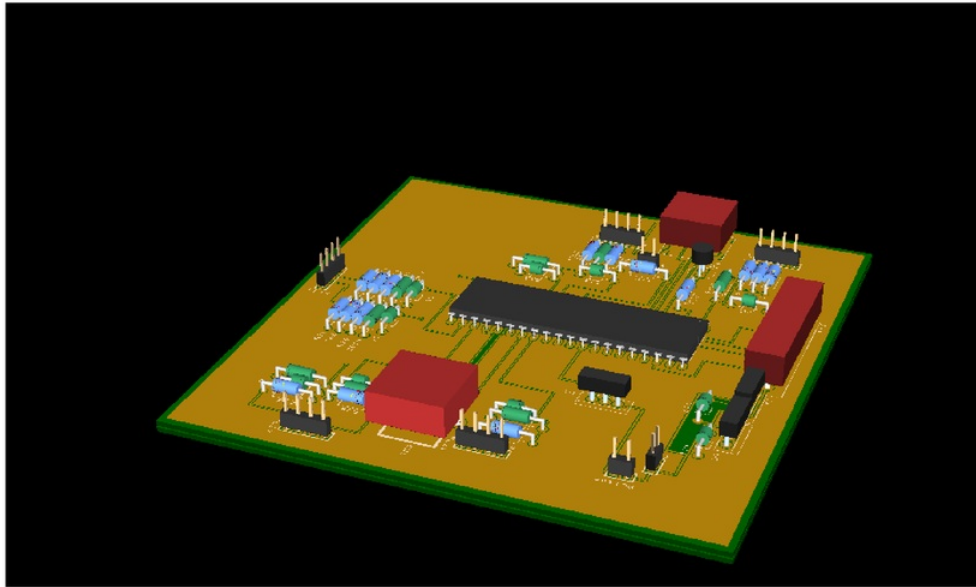
This show all the connections in and out of the PIC The only connection not show is the USB that was directly connected and the power pins. The partial sensor Pin 37,38,39 will be made into RS232 ports.



I found that a lot of connections needed for this product so a bigger pic with 40 pins was needed as 28 pins were not large enough.
This show the pic with all connections made on Easy-pc before PCB-ing the product

The final PCB design in 3d rendering

There are three red sections on the board these represent the SD card, the USB slot, and a 6 pin connection to the board for the partial sensor connection. The board size was This will be used for pricing the board.



All components were kept as close as possible to keep pricing lower and design efficiently. The board has 2 lays a 15v copper layer and 0v copper layer.

The Gary area shows the 15v copper poor area the red show the 0v copper poor area.

Components

Capacitor

1nF Vishay Single Layer Ceramic Capacitor £0.124

Resisters

100 Ohms £0.136

10k Ohms £0.133

Voltage regulator

LM7805CT 5vs £0.808 1X

UA78M33CKCS 3.3v £0.684 1X

LM7815CT 5vs £0.802 1X

Structure diagram

This shows the timing of when the pic will receive and record signals from its sensors. These results are taken from the response time on the chosen sensors.

All results will be saved to the SD card for later analyse.

0 seconds	Temp	Uv	Wind direction	Wind speed	Brightness	Practical Sensor	Humidity	G
1ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
1.5ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
2ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
Repeat until 100ms								
100ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
100.5ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
101ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
repeat until 1s								
1 second	Temp	Uv	Wind direction	Wind speed	Brightness	Practical Sensor	Humidity	G
1000.5ms	Temp	Uv	Wind direction	Wind speed	Brightness		Humidity	
1001ms	Temp	Uv	Wind direction	Wind speed	Brightness	Practical Sensor	Humidity	G
repeat to 10s								
10s	Temp	Uv	Wind direction	Wind speed	Brightness	Practical Sensor	Humidity	G

Cost

The cost has been broken up into 3 seconds the circuit board components cost with does not include and external connections. All the sensors will be put in a category's as these are the largest vales items these items can be changed for a cheaper product. The last will be the casing and the button connection, battery, PCB printing price and a total of overall.

0 Modules					
Quantity	References	Value	Stock Code	Unit Cost	Supplier links
Sub-totals:					
8 Capacitors					
Quantity	References	Value	Stock Code	Unit Cost	Supplier links
8	C3-C4,C7-C11	100nF	RS Pro Aluminium Electrolytic Capacitor 100nF 50V dc 5mm Through Hole RS Series +105°C	£0.02	
Sub-totals:					
16 Resistors					
Quantity	References	Value	Stock Code	Unit Cost	Supplier links
7	R4,R7-R8,R10-R11,R13-R14	10k	RS Pro RS Series Axial Fixed Resistor 10kΩ ±5% 0.5W -500 ? +350ppm/°C	£0.12	
8	R6,R12,R15,R17-R21	100R	RS Pro RS Series Axial Fixed Resistor 100Ω ±5% 2W -500 ? +350ppm/°C	£0.04	
1	R22	220	RS Pro RS Series Axial Fixed Resistor 220Ω ±5% 0.25W -500 ? +350ppm/°C	£0.11	
Sub-totals:					
4 Integrated Circuits					
Quantity	References	Value	Stock Code	Unit Cost	Supplier links
1	U1	PIC18F45K50	Microchip PIC18F45K50-4P, 8bit PIC Microcontroller, 48MHz, 32 kB Flash, 40-Pin PDIP	£2.30	
1	U2	7805	STMicroelectronics L7805ACV Linear Voltage Regulator, 1A, 5 V, 2% 3-Pin, TO-220	£1.00	
1	U3	7803	Texas Instruments UA78M33CKCS Linear Voltage Regulator, 500mA, 3.3 V 3-Pin, TO-220	£1.03	
1	U4	7815	Standard Regulator Neg -15V 1.5A TO220	£0.65	
Sub-totals:					
0 Transistors					
Sub-totals:					
9 Diodes					
Quantity	References	Value	Stock Code	Unit Cost	Supplier links
8	D3-D4,D7-D11	1N4733A	Fairchild Zener Diode, 5.1V 5% 1 W Through Hole 2-Pin DO-41	£0.06	
1	D12	LED	Biwer 566 nm, 625 nm Green & Red High-Power LED, 3-Pin 3mm (F-1) Dome Diffused Through Hole package	£0.19	
Sub-totals:					
9 Miscellaneous					
Quantity	References	Value	Stock Code	Unit Cost	Supplier links
1	J1	USBCONN	Würth Elektronik WR-COM Series, Through Hole Type A USB Connector, Receptacle	£1.85	
6	RV2-RV4,RV6,RV8-RV9	1k	Sensors		
Sub-totals:					
1	SD1	SD	Hirose 9 Way Right Angle Micro-SD Memory Card Connector with Solder Termination	£1.86	
1	SW1	SW-SPST	SPST Momentary, Off Miniature Push Button Switch, IP67, 13.6 (Dia.)mm, Square Threaded Yellow LED	£2.25	
Sub-totals:					
Totals:					
				£12.79	

All part above components were priced from uk.rs-online.com on the 05/01/2018.

This shows all the pricing Sensor this is the greatest expense in this project.

Sesnor	Product	Price	Links
TEMPERATURE & HUMIDITY SENSOR	LOXONE OUTSIDE TEMPERATURE & HUMIDITY SENSOR Part. No.: 200031	£129.00	https://shop.loxone.com/enuk/outside-temperature-humidity-sensor.html
Wind direction/ soeed	Ultrasonic Wind SensorWindSonic	£765.00	https://www.r-p-r.co.uk/windsystems/windsonic.php?gclid=Cj0KCQiAvrfSBRC2ARIsAFumcm8p6n0TKkalPUDxgIjcUUmvoOI62u8w_H4hwbAL8Hp09ouGlxUnFYMaAo6WEALw_wcB
Particulate Matter Sensors	Enclosure Housing for Alphasense OPC-N2 Particulate Matter Sensors / Optical Particle Counters for PM1 & PM2.5 & PM10 Industrial IoT Air Quality Monitoring with Tools.Valarm.net	£29	https://shop.valarm.net/products/enclosure-housing-for-alphasense-opc-n2-particulate-matter-sensor-optical-particle-counter-for-pm1-pm2-5-pm10-iiot-industrial-iiot-air-quality-monitoring
Brightness sensor	MTN663593 Brightness sensor	£126	https://www.schneider-electric.co.uk/en/product/MTN663593/brightness-sensor%2C-light-grey
UV sensor	Model SU-100	£175	https://www.apogeeinstruments.co.uk/uv-sensor-su-100/
GPS Module	A2035H - GPS Module, with Antenna, SIRFStar IV GPS Engine	£17.47	http://uk.farnell.com/maestro-wireless-solutions/a2035h/gps-module-w-ant-sirf-iv/dp/2281693
Total of all sensors		£1,241.47	

Section 3 shows other items need for this product. That is not sensor or mounted to PCB

Item	Product	Price	Link
Battery	Nimh Battery: 24V 20Ah (M cell) Rechargeable Battery Pack	£650	http://www.batteryspace.com/nimh-battery-24v-20ah-m-cell-rechargeable-battery-pack.aspx
Button	SPST-NO Momentary Miniature Push Button Switch, IP67, Panel Mount	£9.28	rs-online.com
Connection male	Jaeger, 6 Pole Cable Mount Connector Plug, IP65, 1 Shell Size, Male Contacts	£40	rs-online.com
Connection female	Jaeger S324 Series, 6 Way Cable Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 1	£28	rs-online.com
Casing	TEMPO ABS Enclosure, IP65, 289 x 239 x 107.4mm	£21	https://uk.rs-online.com/web/p/general-purpose-enclosures/0104076/
Pcb Price	Size 113.4 x 109.9mm	£25.14	http://www.pcbway.com/
	Total	£774	

Final overall Costs

Sensors	£1,241.47
Other Items(Battery, Button, Connection, PCB	£744
Components cost	£12.79
Total for Project Including everything	£1,998.26

Improvements

After Review of portable weather measurement systems, there were a few improvements that could have been implied such as like HM-1 Portable HAZMAT being able to read data instantly is someone vital as this product works with hazardous material incidents a screen on this product could have proved that extra live data being able to advise immediately. Another thing that the HM1 had that would have been a good implantation is that a lot of it sensor was built on board all contained in a rugged case for harsh environment. Putting all the sensor put in one package would have improved the probability vastly.

Davis Instruments 6250-MOBILE Wireless Mobile Weather Station was able to wirelessly transmit its data to a handheld console this could of help putting the device in areas humans and always go in too such as high in the mounting. Give a product more using is always better as it as more flexibility when it comes to environments



A terminal like this could help with accessibility to all data needed.

Having a casing that could heat itself this could avoid damaging components in harsh weather here this could affect component readings.

One of the biggest problem for this portable derives is power measuring so many different things can cause a large battery to be a need. But a way to get around this would be using a solar panel or wind turbine to recharge the battery while in use

Making the product a lot smaller with maybe not so many sensors could be best for some situations the Ambient Weather WM-4 Handheld Weather Station shows how this can be archived with only a few sensors build in but can fit in the palm of your hand collecting data instant

Being able to connect all sensor to one poll that could be implanted in the ground would give a vast improvement to easy of setup just planting all your sensors in one place just off the ground would give a lot better results as no leaves or other material could get blocked in your sensors and give less errors in data.

Report

After Reviewing portable weather measurement systems from the industry stand like the Hm-1 down to the more consumer-friendly Weather WM-4 Handheld Weather Station these give a good idea of how companies are getting around a big problem, Power consumption, can be a big issues like if you needed a product to last a few month without any maintained. The Davis Instruments 6250-MOBILE Wireless Mobile Weather Station get around this problem by using solar panels build with this the device can last two years without any charging needed. This product also solves the problem of putting your device that human cannot reach by transmitting its data to a handheld console.

Some of the high-end instrument came with such thing as de-icing modes and low power modes these devices would also be working with hazardous materials using complex coding to working out the spread and strength of the air born materials.

The low-end instrument was also very specific devices containing everything that would be needed for average day weather tracking the WM-4 Handheld Weather has nearly all the sensor need. But not having a strong battery life and not being able to collect all the data need it does fall short of the high-end instrument

reviewing all sensor need and comparing them together this was to make sure the best device was chosen collecting all the connections, operating voltages and signal outputs from there datasheets it was possible to move on to the Pic selection.

After reviewing a few Pics with specifications such as

Pins	Operating Voltage Range (V)	Clock speed	Digital inputs	Analog inputs	Ram	Program Memory Flash	Analog to digital	Data bus	Digital Communication Peripherals

It was possible to choose what pic would have been most suitable for this project.

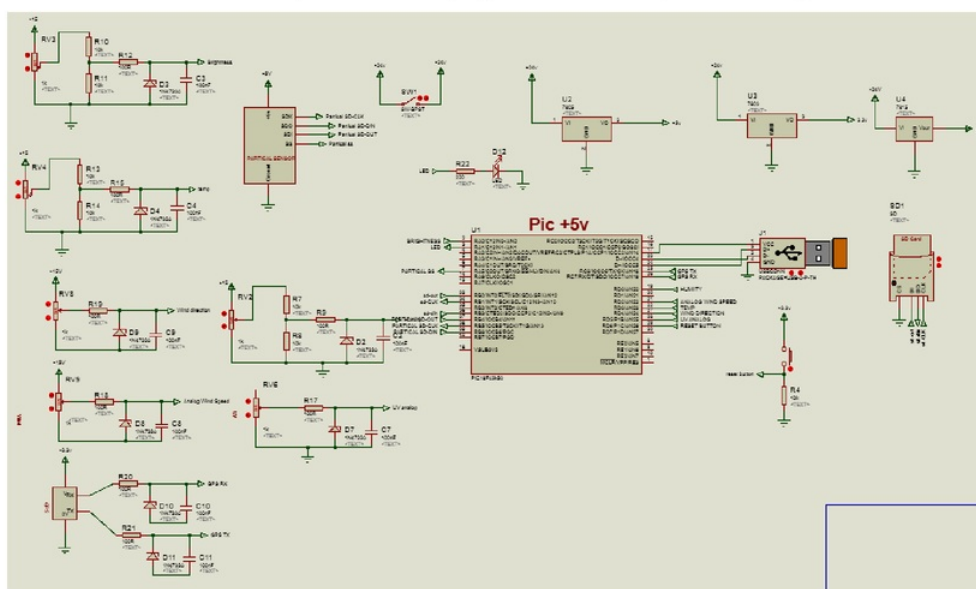
At first the PIC18f14k50 was chosen but this was found not to have enough pins for the project after finding out that converting rs232 would need a max232chip so different sensor was chosen that had an analog output or a digital output the PIC18f14k50 still was not big enough for the new sensor that is shown in this project

so the Pic18f45k50 was chosen for this project

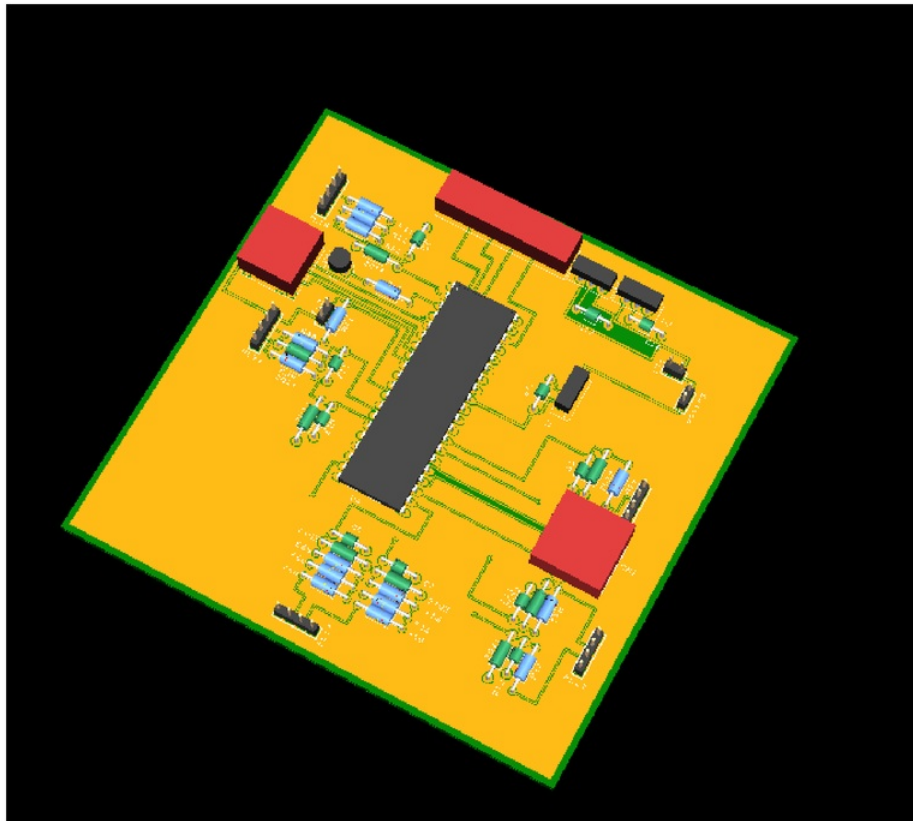
Finding a case that had a good operating temperature range was need as it was unsure what environment this device would be used above ip65 was chosen to be suitable for it to be protected from the elements.

This device stores all its data on to SD card with up to 32gb of storage.

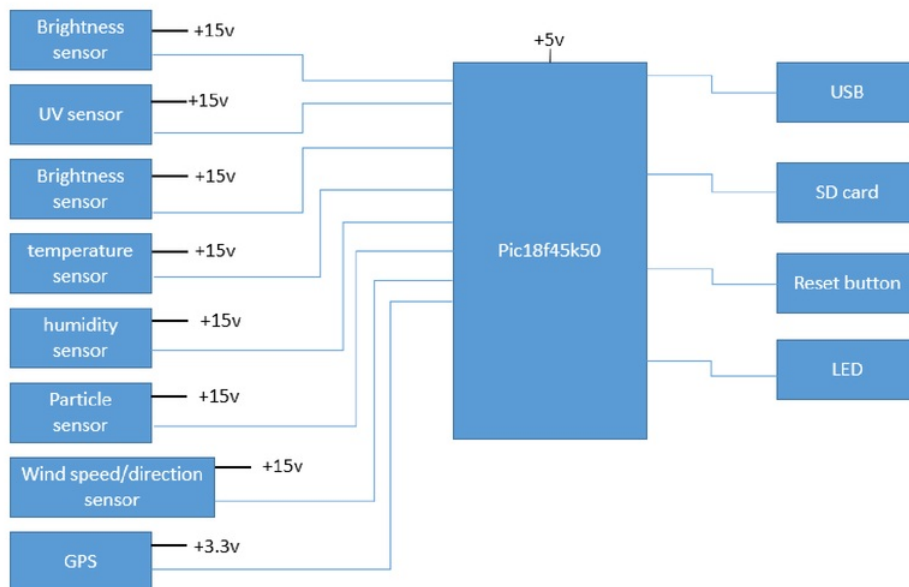
With no Max cost of this project, it was possible to use the best sensors suitable that was available on the market. This did the higher cost of the project but made the parts used very reliable.



After picking suitable sensors and analysing their data sheet it was possible to make a basic block diagram of how the circuit should be designed. Not much filtering was needed in the design as good quality sensors were picked so no filtering has been added to the design.



The final PCB Looks is very practical not using up much space. This was achieved by using copper lays on the board. With the USB connector and SD connect being in the case to not attached externally to prevent data loss. This show a basic diagram of the final design



Referencing

- [1] "Weather Transmitter WXT530 Series a unique series of sensors in a compact format | Vaisala." [Online]. Available: <https://www.vaisala.com/en/products/instruments-sensors-and-other-measurement-devices/weather-stations-and-sensors/wxt530>. [Accessed: 05-Jan-2018].
- [2] "Ambient Weather WM-4 Handheld Weather Meter w/ Windspeed, Direction, Temperature, Humidity, Compass, Dew Point, Comfort Index, Psychrometer." [Online]. Available: <https://www.ambientweather.com/amwm4.html>. [Accessed: 05-Jan-2018].
- [3] "Davis Instruments 6250-MOBILE Wireless Mobile Weather Station (discontinued)." [Online]. Available: <https://www.ambientweather.com/dain62wimowe.html>. [Accessed: 05-Jan-2018].
- [4] "New/Popular PIC18 MCU Products - Microchip Technology Inc." [Online]. Available: <http://www.microchip.com/param-chartsearch/chart.aspx?branchid=1004&mid=10&lang=en&pageid=74>. [Accessed: 05-Jan-2018].
- [5] "PIC16(L)F1454/5/9," *PIC16(L)F1454/5/9*.
- [6] "PIC16F1455 - Microcontrollers and Processors." [Online]. Available: <https://www.microchip.com/wwwproducts/en/PIC16F1455>. [Accessed: 05-Jan-2018].
- [7] "PIC16F1459 - Microcontrollers and Processors." [Online]. Available: <https://www.microchip.com/wwwproducts/en/PIC16F1459>. [Accessed: 05-Jan-2018].
- [8] "PIC18F14K50 - Microcontrollers and Processors." [Online]. Available: <http://www.microchip.com/wwwproducts/en/PIC18F14K50>. [Accessed: 05-Jan-2018].
- [9] "PIC18F2450/4450 Data Sheet."
- [10] "PIC18F25K50 - Microcontrollers and Processors." [Online]. Available: <http://www.microchip.com/wwwproducts/en/PIC18F25K50>. [Accessed: 05-Jan-2018].
- [11] "PIC18F45K50 - Microcontrollers and Processors." [Online]. Available: <http://www.microchip.com/wwwproducts/en/PIC18F45K50>. [Accessed: 05-Jan-2018].
- [12] "RainWise HM-1 Portable HAZMAT Weather Station." [Online]. Available: <http://www.fondriest.com/rainwise-hm-1-portable-hazmat-weather-station.htm>. [Accessed: 05-Jan-2018].
- [13] "TA292411 | TEMPO ABS Enclosure, IP65, 289 x 239 x 107.4mm | Fibox." [Online]. Available: <https://uk.rs-online.com/web/p/general-purpose-enclosures/0104183/>. [Accessed: 05-Jan-2018].
- [14] "Heavy Duty Enclosures - Polycarbonate Cases - Polycarbonate Clear Lid Cases - ABS Cases - ABS Clear Lid Cases - Flanged IP66 Enclosure - Wall Mount IP66 Enclosure - Sealed Wall Mount Enclosures | Heavy Duty Enclosures, Polycarbonate Cases, Polycarbonate Clear Lid Cases, ABS Cases, ABS Clear Lid Cases, Flanged IP66 Enclosure, Wall Mount IP66 Enclosure, Sealed Wall Mount Enclosures." [Online]. Available: <http://camdenboss.com/enclosures/heavy-duty-enclosures>. [Accessed: 05-Jan-2018].
- [15] "IP65 ABS Boxes, Watertight ABS Boxes, Waterproof Black ABS Boxes, IP65 Wall Mounted ABS Boxes | IP65 ABS Boxes, Watertight ABS Boxes, Waterproof Black

ABS Boxes, IP65 Wall Mounted ABS Boxes.” [Online]. Available: <http://camdenboss.com/enclosures/universal-enclosures/flanged-ip65-abs-enclosures>. [Accessed: 05-Jan-2018].

- [16] “A-USBSA | ASSMANN WSW Right Angle, Through Hole Type A USB Connector, Receptacle | ASSMANN WSW.” [Online]. Available: <https://uk.rs-online.com/web/p/type-a-usb-connectors/6741325/>. [Accessed: 05-Jan-2018].
- [17] “61400826021 | Wurth Elektronik WR-COM Series, , Through Hole Type A USB Connector, Receptacle | Wurth Elektronik.” [Online]. Available: <https://uk.rs-online.com/web/p/type-a-usb-connectors/7480879/>. [Accessed: 05-Jan-2018].
- [18] “DM3AT-SF-PEJM5 | Hirose 8 Way Right Angle Micro SD Memory Card Connector with Solder Termination | Hirose.” [Online]. Available: <https://uk.rs-online.com/web/p/memory-sim-card-connectors/8281884/>. [Accessed: 05-Jan-2018].
- [19] “SDHR-8BRS-K-363-A0-P-ETB(HF)(A) | JST 8 Way Micro SD Memory Card Connector with Snap-In Termination | JST.” [Online]. Available: <https://uk.rs-online.com/web/p/memory-sim-card-connectors/9060115/>. [Accessed: 05-Jan-2018].
- [20] “SanDisk SDSDU-064G-U46 Ultra SDXC UHS-I Class 10 Memory Card up to 30 MB/s read - 64 GB: Amazon.co.uk: Computers & Accessories.” [Online]. Available: <https://www.amazon.co.uk/SanDisk-SDSDU-064G-U46-Ultra-UHS-I-Memory/dp/B007BJHEZW>. [Accessed: 05-Jan-2018].
- [21] “IBR3SAD900 | SPST-NO Momentary Miniature Push Button Switch, IP67, Panel Mount | APEM.” [Online]. Available: <https://uk.rs-online.com/web/p/push-button-switches/0225139/>. [Accessed: 05-Jan-2018].
- [22] “[SPST Momentary, Off Miniature Push Button Switch, IP67, 13.6 (Dia.)mm, Square Threaded Yellow LED |.” [Online]. Available: <https://uk.rs-online.com/web/p/push-button-switches/8919823/>. [Accessed: 05-Jan-2018].
- [23] “TL22DDAW015D | Toggle Switch IP65 DPDT On-On, 3 A @ 250 V ac, Panel Mount Illuminated | NKK Switches.” [Online]. Available: <https://uk.rs-online.com/web/p/toggle-switches/4537938/>. [Accessed: 05-Jan-2018].
- [24] “5324 730 06 | Jaeger, 6 Pole Cable Mount Connector Plug, IP65, 1 Shell Size, Male Contacts | Jaeger.” [Online]. Available: <https://uk.rs-online.com/web/p/products/3246316/>. [Accessed: 05-Jan-2018].
- [25] “5324 130 06 | Jaeger 5324 Series, 6 Way Cable Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 1 | Jaeger.” [Online]. Available: <https://uk.rs-online.com/web/p/mil-spec-circular-connectors/2855284/>. [Accessed: 05-Jan-2018].
- [26] “TT531/10K3A1 | Temperature Sensor -10 → +110 °C, -10 → +40 °C, RS Pro TT531/10K3A1, Outside Air, Thermistor | RS Pro.” [Online]. Available: <https://uk.rs-online.com/web/p/temperature-sensors/0813828/>. [Accessed: 05-Jan-2018].
- [27] “Indoor, outdoor and channel RTD temperature probe,” 2011.
- [28] Didactum, “Zertico datasheet Weatherproof Outdoor Temperature Sensor.”
- [29] “Documentation - Loxone Temperature and Humidity Sensor Air.” [Online]. Available: <https://www.loxone.com/enen/kb/temperature-humidity-sensor-air/>. [Accessed: 05-Jan-2018].

- [30] "SHO100-T - SHO100 - room humidity outdoor sensor - I/NET - Vista | Schneider Electric." [Online]. Available: <https://www.schneider-electric.com/en/product/SHO100-T/sho100---room-humidity-outdoor-sensor---i-net---vista/>. [Accessed: 05-Jan-2018].
- [31] "AM2315 - Encased I2C Temperature/Humidity Sensor ID: 1293 - \$29.95 : Adafruit Industries, Unique & fun DIY electronics and kits." [Online]. Available: <https://www.adafruit.com/product/1293>. [Accessed: 05-Jan-2018].
- [32] "Anemometer Wind Speed Sensor w/Analog Voltage Output ID: 1733 - \$44.95 : Adafruit Industries, Unique & fun DIY electronics and kits." [Online]. Available: <https://www.adafruit.com/product/1733>. [Accessed: 05-Jan-2018].
- [33] "0 5V/4 20ma 485 Type Wind Speed Sensor/Voltage Output Anemometer/360 Degree Factory Supplying With Better Quality And Service-in Speed Measuring Instruments from Tools on Aliexpress.com | Alibaba Group." [Online]. Available: <https://www.aliexpress.com/item/0-5V-4-20ma-RS485-Type-Wind-Speed-Sensor-Voltage-Output-Anemometer-360-Degree/32615110162.html>. [Accessed: 05-Jan-2018].
- [34] "05103-L: Wind Monitor." [Online]. Available: <https://www.campbellsci.com/05103-l>. [Accessed: 05-Jan-2018].
- [35] "full-text."
- [36] "WindSonic Ultrasonic Wind Sensor | Gill Instruments." [Online]. Available: <http://gillinstruments.com/products/anemometer/windsonic.htm>. [Accessed: 05-Jan-2018].
- [37] W. Zhou Yong, "Digital universal particle concentration sensor PMS1003 series data manual," 2016.
- [38] "Air Monitors - Air Quality Monitoring Technology Specialists." [Online]. Available: <https://www.airmonitors.co.uk/>. [Accessed: 05-Jan-2018].
- [39] "Widens partial counter." Available: rs-components.com/2312314/Widens-partial0932/. [Accessed: 05-Jan-2018].
- [40] "OPC." [Online]. Available: <http://www.alphasense.com/index.php/products/optical-particle-counter/>. [Accessed: 05-Jan-2018].
- [41] "Light to Frequency Converter - TSL235R - SEN-09768 - SparkFun Electronics." [Online]. Available: <https://www.sparkfun.com/products/9768>. [Accessed: 05-Jan-2018].
- [42] "89750183 | Crouzet LDR1 Light Sensor for use with Millenium III Series | Crouzet." [Online]. Available: <https://uk.rs-online.com/web/p/plc-accessories/6832336/>. [Accessed: 05-Jan-2018].
- [43] "S+S Regeltechnik: AHKF." [Online]. Available: <https://spluss.de/en/products/light-intensity-and-motion/light-intensity-sensors/ahkf/>. [Accessed: 05-Jan-2018].
- [44] "MTN663593 - Brightness sensor, light grey | Schneider Electric." [Online]. Available: <https://www.schneider-electric.co.uk/en/product/MTN663593/brightness-sensor%2C-light-grey>. [Accessed: 05-Jan-2018].
- [45] "SI1145 Digital UV Index / IR / Visible Light Sensor ID: 1777 - \$9.95 : Adafruit Industries, Unique & fun DIY electronics and kits." [Online]. Available: <https://www.adafruit.com/product/1777>. [Accessed: 05-Jan-2018].

- [46] M. M. Typ and E. W. Factor, "Absolute Maximum Ratings Electro-Optical Characteristics (at 25 °C °C °C °C) Relative Responsivity Output Voltage along UV Index Parameter Symbol = Unit Spectral Detection Range."
- [47] M. M. Typ, "Absolute Maximum Ratings Electro-Optical Characteristics (at 25 °C) Output Voltage along UV power."
- [48] "full-text."
- [49] "GeoKYLIA Geocube : Millimetric position sensor based on GPS." [Online]. Available: <http://kylia.com/geokylia/?portfolio=geocube>. [Accessed: 05-Jan-2018].
- [50] "Adafruit Ultimate GPS," 2017.
- [51] "Positioning Product Stack-up Antenna SiRFstarIV Integrated Solution."
- [52] "DEA BAT 24v Rechargeable Batteries." [Online]. Available: <http://www.rollingcenter.co.uk/bat.html>. [Accessed: 05-Jan-2018].
- [53] "24V Rechargeable Battery Sale : Save up to 82%." [Online]. Available: <http://www.smarterdeal.co.uk/search?q=24v+rechargeable+battery>. [Accessed: 05-Jan-2018].
- [54] "APC Smart-UPS 24V XL (SU24XLBP) 12V 18Ah UPS Battery - This is an AJC Brand® Replacement - Newegg.com." [Online]. Available: <https://www.newegg.com/Product/Product.aspx?Item=1T0-0003-037V0>. [Accessed: 05-Jan-2018].
- [55] "Nimh Battery: 24V 20Ah (M cell) Rechargeable Battery Pack." [Online]. Available: <http://www.batteryspace.com/nimh-battery-24v-20ah-m-cell-rechargeable-battery-pack.aspx>. [Accessed: 05-Jan-2018].

Portable weather systems

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

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RYAN O'SULLIVAN**61.40****RESEARCH-INFORMED LITERATURE**

Reasonable literature review but would be improved by adding more devices/systems and tabling the devices to show relative strengths and weaknesses. 55%

8.25**KNOWLEDGE AND UNDERSTANDING**

Good overall schematic design but a few problems can be seen. Din on the Pic should connect to Dout on the sd card, like wise Dout on the Pic should connect to Din on the sd card. The UV sensor simulator is not connected to a power source. Good pcb layout although you cannot make the same net appear both sides of a switch without generating an error, each sub net requires a different name. 62%

21.75**ANALYSIS**

Good selection of microcontroller. Good selection of sensors. Good case selection but there are no images. No selection of connectors. All of these selections would have benefitted from being tabled to make selection easier and to ensure that the reader could get to the data quickly and efficiently. 58%

17.4

PRACTICAL APPLICATION AND DEP.

- | | | |
|---|---|----------|
|  | Costings nicely put forward as a table with price with supplier of component. Good attempt at future enhancements.70% | 7 |
|---|---|----------|

SKILLS FOR PROFESSIONAL PRAC.

- | | | |
|---|--|----------|
|  | The report is reasonably presented with a good diagrams and flowchart it's a pity the data has not been tabled to make things clearer. Very Comprehensive selection of references. 70% | 7 |
|---|--|----------|