Autonomous Smart Suitcase ASS

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Definition

ASS is an Autonomous Smart Suitcase that will follow the user wherever he goes. Apart from this it also has additional features such as bag fall detection and manual control mode using the app. The bag will mainly be used by commuters, handicapped people and others in indoor facilities.

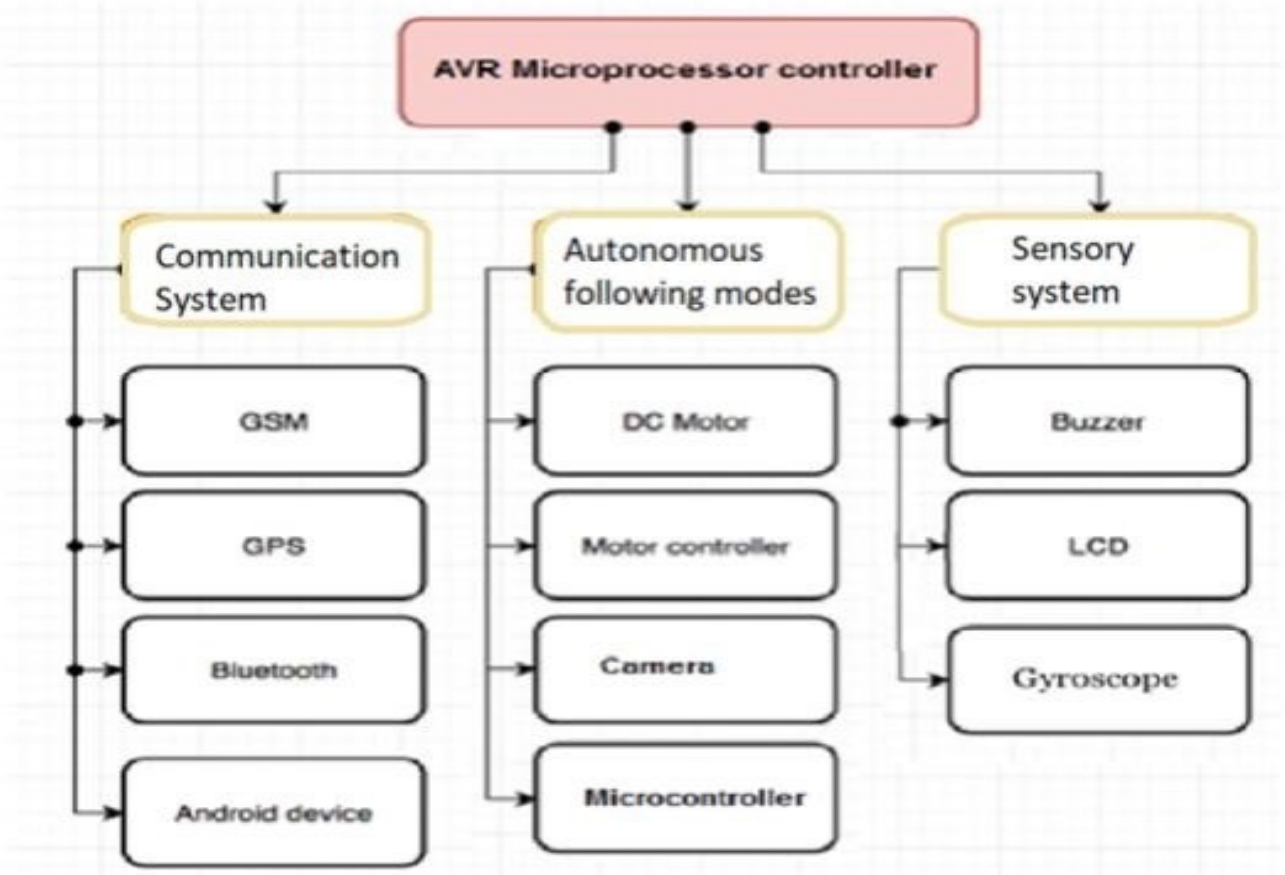
Objectives

1. Simulates the latest advanced technology of the actual autonomously following.
2. Reduces the need for the human control interference.
3. Acquires capability to develop the artificial intelligence systems.
4. Acquiring the ability to integrate theoretical knowledge and practical skills by designing a real-world application based on specification requirements

Specifications

- Max weight of luggage: 4 Kg
- Speed: 3km/h
- Operating Time on full charge: 3h
- Wireless: Bluetooth, GPRS, GPS
- Image recognition: 2 m Max distance, 20 cm stop

Architecture



Project architecture

Updated Sub system 1: Wireless communication and GPS tracking

Main function:

- GPRS Communication between bag and the user
- GPS signal reception for the location of the bag
- Bluetooth connection between user and the bag

Hardware used:

- SIM 900 GSM chip
- Adafruit GPS chip
- HC 06 Bluetooth chip
- Android device

Updated Sub system 2: User following autonomous mode

- **Main function:**
  - Follow the user autonomously
  - Detect of the bag falls down and make a notification
  - Detect user and follow using image recognition
  - Move the bag according to the position of the user
- **Hardware used:**
  - DC motor
  - DC motor controller
  - Camera
  - Microcontroller

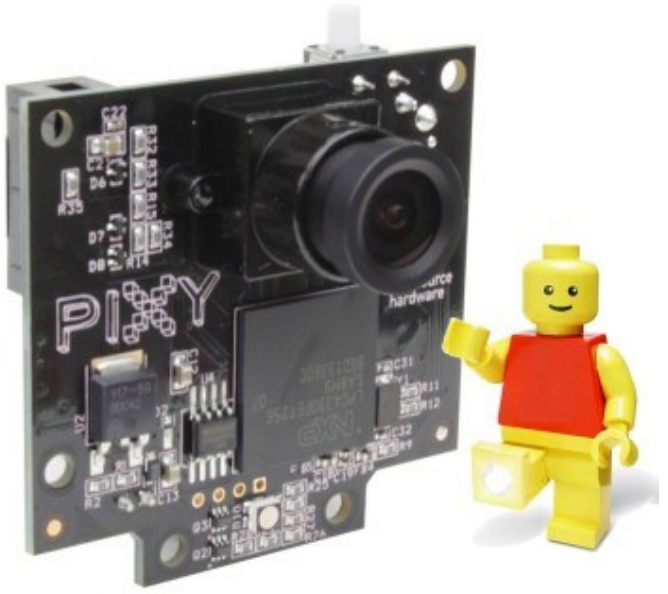
Updated Sub system 3: Sensory sub system

Main function:

- Notify using the buzzer
- Detect the orientation of the bag using a gyroscope
- Detect the distance between the user and the bag
- Display user Identification on screen

Hardware used:

- Gyroscope
- Buzzer
- LCD
- Ultrasonic Sensor



Testing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Testing and results: GSM

- **Description**: An SMS was sent from the module to our phone

No	Test conditions	Difficulty faced or notes	Test result
1	Done in an area with good signal coverage for “Zain”	Jumper pins of the module were confusing	An SMS was successfully sent at the end
2	Communication was done at 9600 baud	Module needs to be switched on physically each time	
3	A zain sim card was used	Module needs 1 A external power supply each time	


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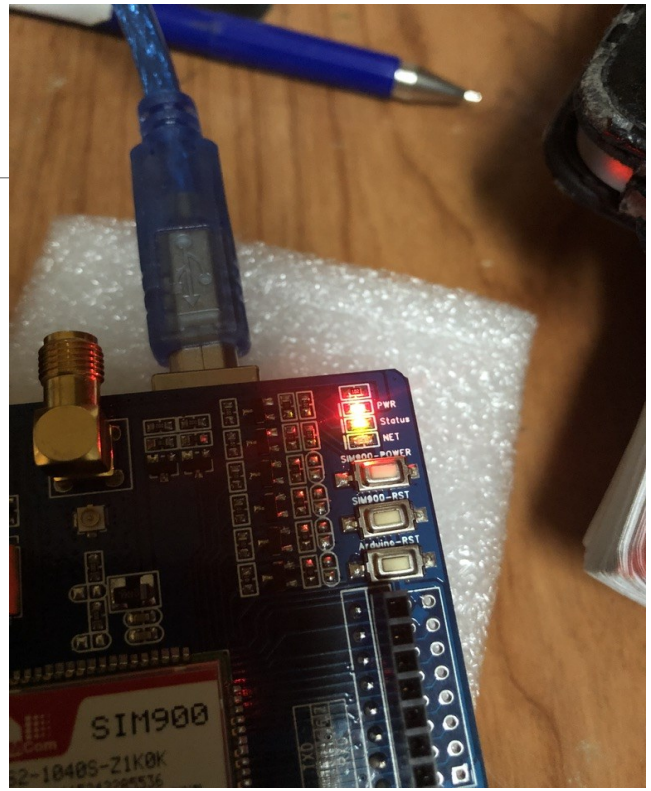
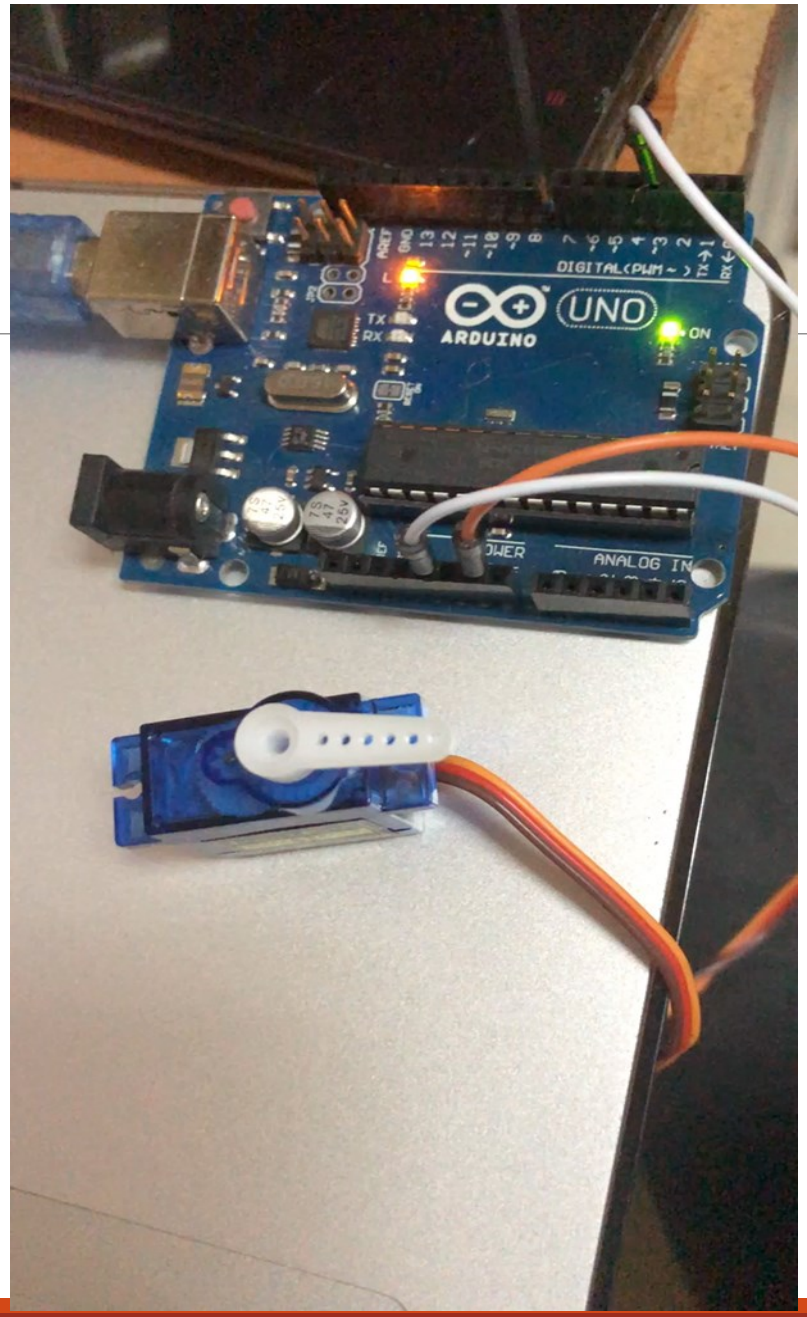
SIM900
S2-1040S-Z1K0K

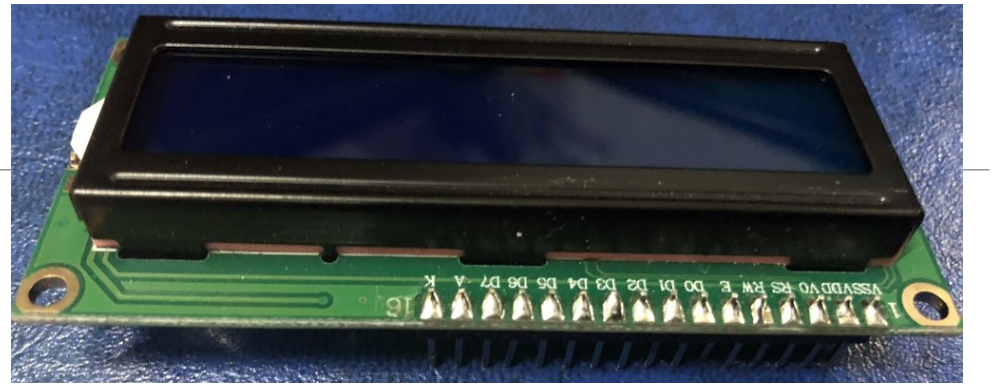

PWR
Status
NET
SIM900-POWER
SIM900-RST
Arduino-RST
SIM900

Testing and results: LCD & Servo

- **Description**: Sample data is displayed on the LCD, Servo is tested

No	Test conditions	Difficulty faced or notes	Test result
1	12 V DC supply is used	Multiple wires for LCD make setup a little difficult	Sample data was successfully displayed
2	No load is connected to servo		Servo was tested for 180 degree sweep
3	LCD contrast is set to 2.5 V		
4	Backlight of LCD is powered		


DIGITAL(PWM~)
UNO
ARDUINO
ON
ANALOG IN

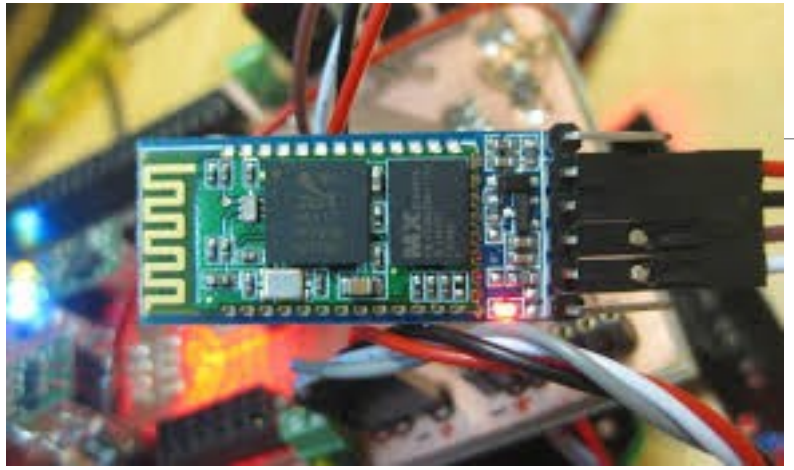


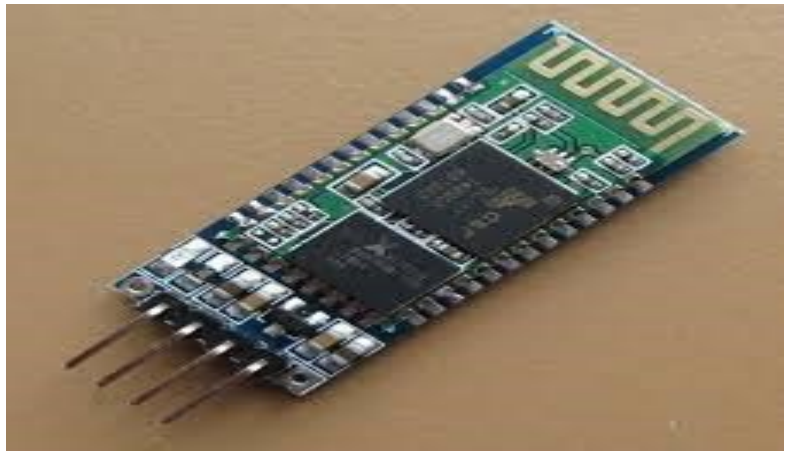

Liquid Crystal

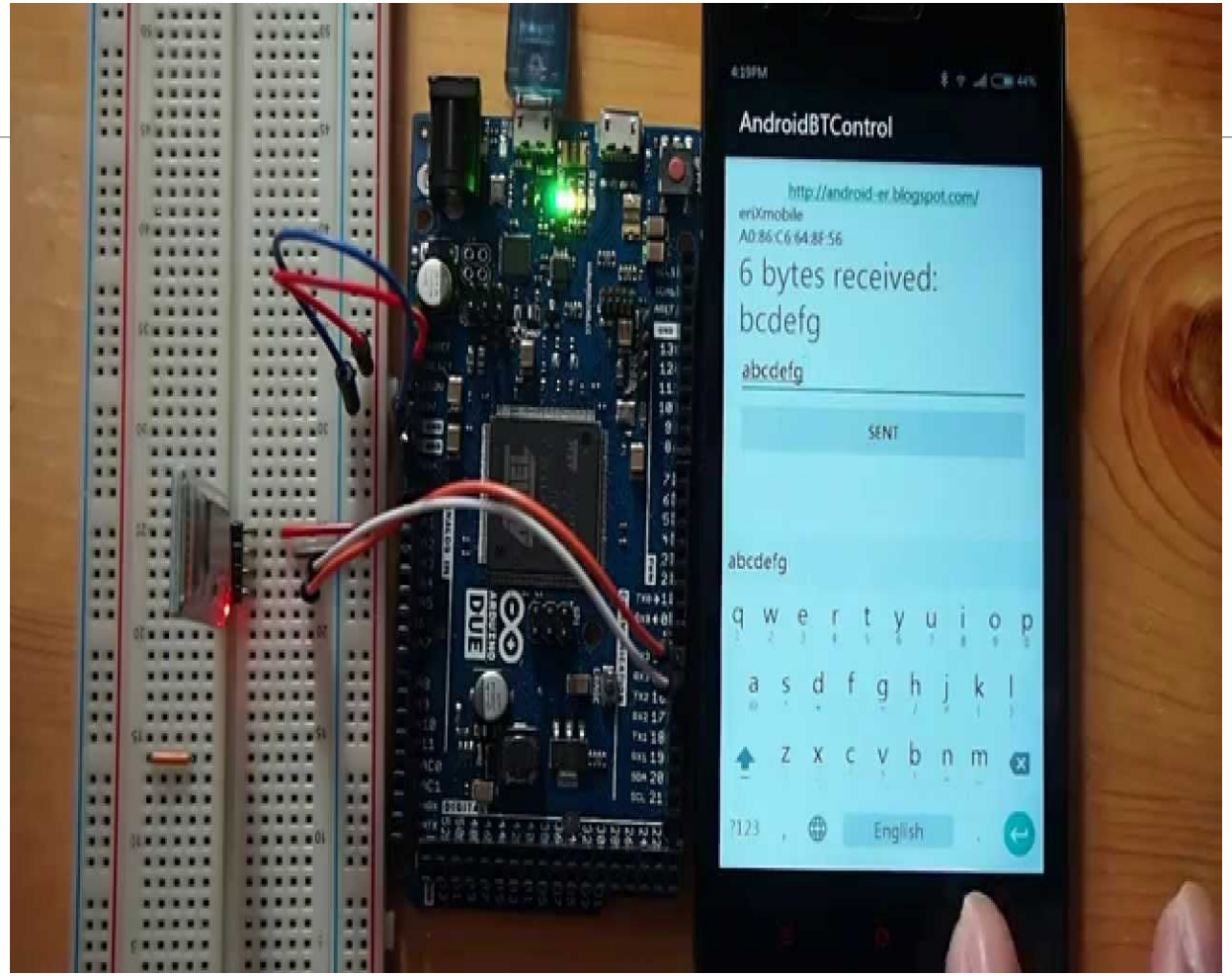
Testing and results: Bluetooth

- **Description**: Data is sent and received from the system to android device

No	Test conditions	Difficulty faced or notes	Test result
1	Baud rate for communication at 9600	Tx of Bluetooth must be connected to Rx of Arduino and	Data was successfully sent from Arduino and received on the android device
2	ASCII(Keyboard characters) are sent and received	Rx of Bluetooth must be connected to Tx of Arduino and	Data was successfully sent from Android device and received on the Arduino
3	Android device is used to pair	There should be software delay in transmission to avoid overload	
4	Backlight of LCD is powered	Any pins can be used for transmission on the arduino by using “Software serial”	
5	Android 6.0 version is used		





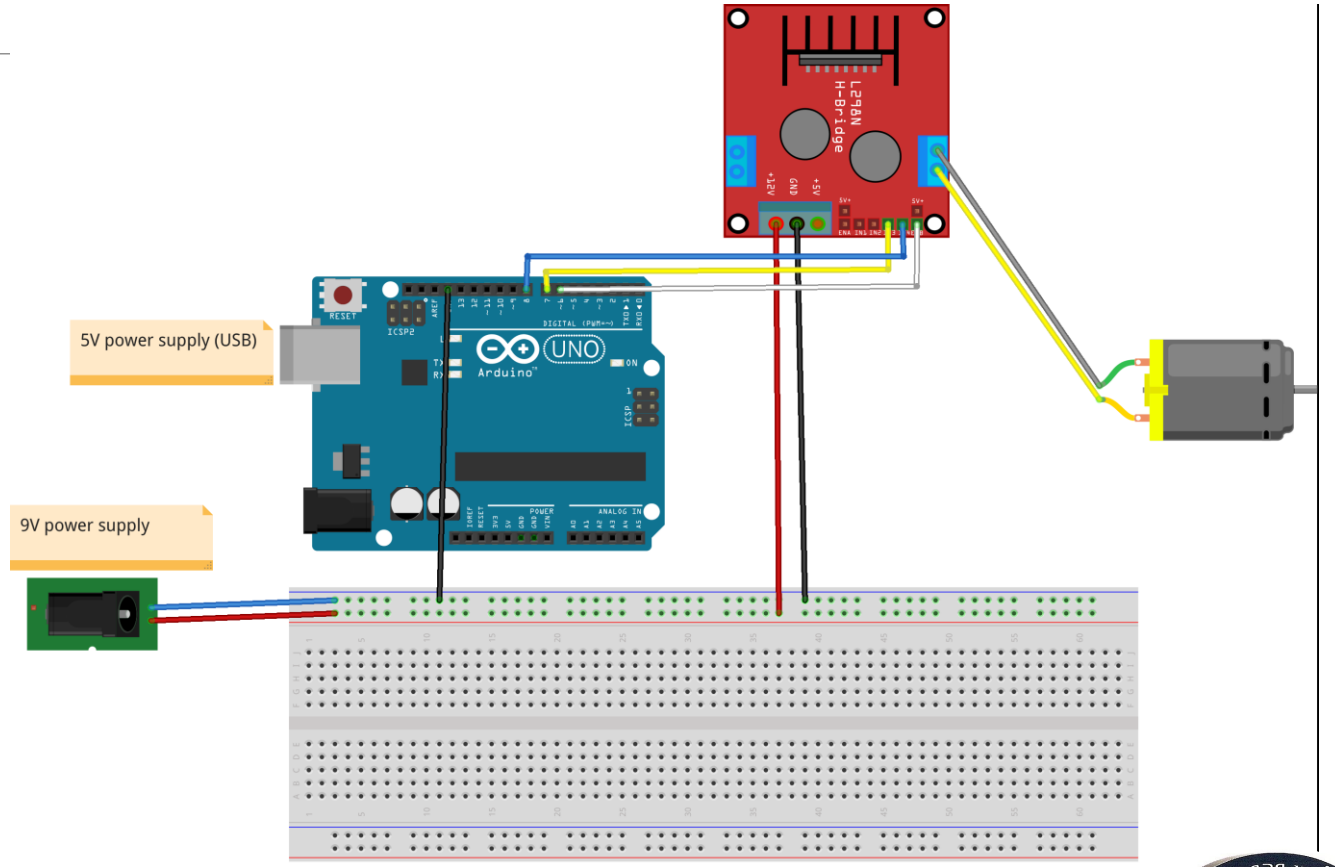

AndroidBTControl
http://android-er.blogspot.com/
6 bytes received:
bcdefg
abcdefg
SENT
abcdefg
English

Testing and results: Motor and controller

- **Description**: Control the DC motor for both directions

No	Test conditions	Difficulty faced or notes	Test result
1	12 V DC supply is used	Initial setup was difficult	Motor was successfully controlled
2	The speed is set to max in the program		
3	No load is connected to the motor		


12V


5V power supply (USB)
9V power supply
L298N
H-Bridge
UNO
Arduino

Testing
Main challenge faced: Old idea

The idea was to make the bag follow the ping coming from the user

Ping transmitter

Left

Front

Right

3 Ping Receivers

Testing
Main challenge faced: New idea

The idea was to make the bag follow the user by following specific color and ultrasonic added to accurate the distance

Ping transmitter

Image Sensor

Ping transmitter

Testing
Drawbacks of old idea

- Sensor is not reliable
- No feedback to make bag stop once its too close to the user
- Misses pings at times
- Very slow response
- New solution: Camera is used to detect user and follow

Tasks distribution

Project Management: Task Division

Task	Ali S	Fawaz	Naseer	Abdullrahman	Ali Makki
Search & acquire components	24%	24%	24%	24%	4%
Design Subsystems	24%	24%	24%	24%	4%
Test & Calibrate Subsystems	20%	25%	20%	20%	15%
Write Reports & Presentations	20%	20%	20%	20%	20%

Completed work

Completed Work

Sub-systems

i. Wireless Communication

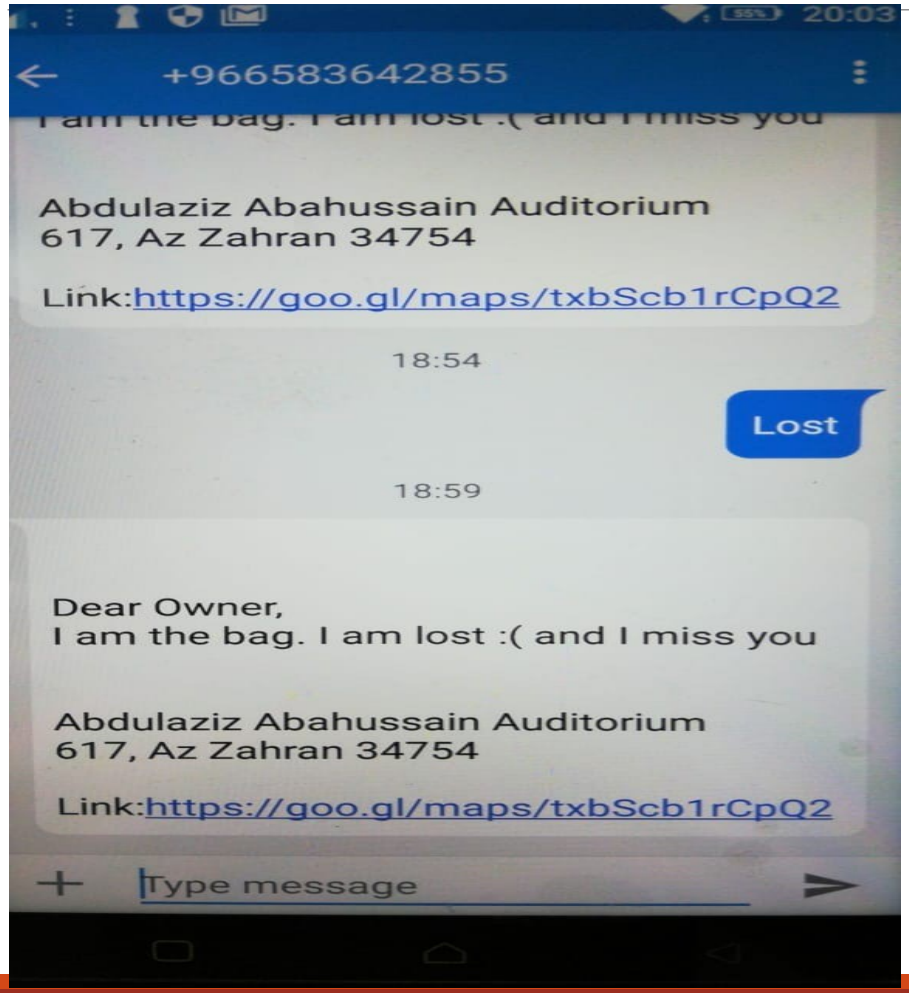
ii. User following autonomous mode

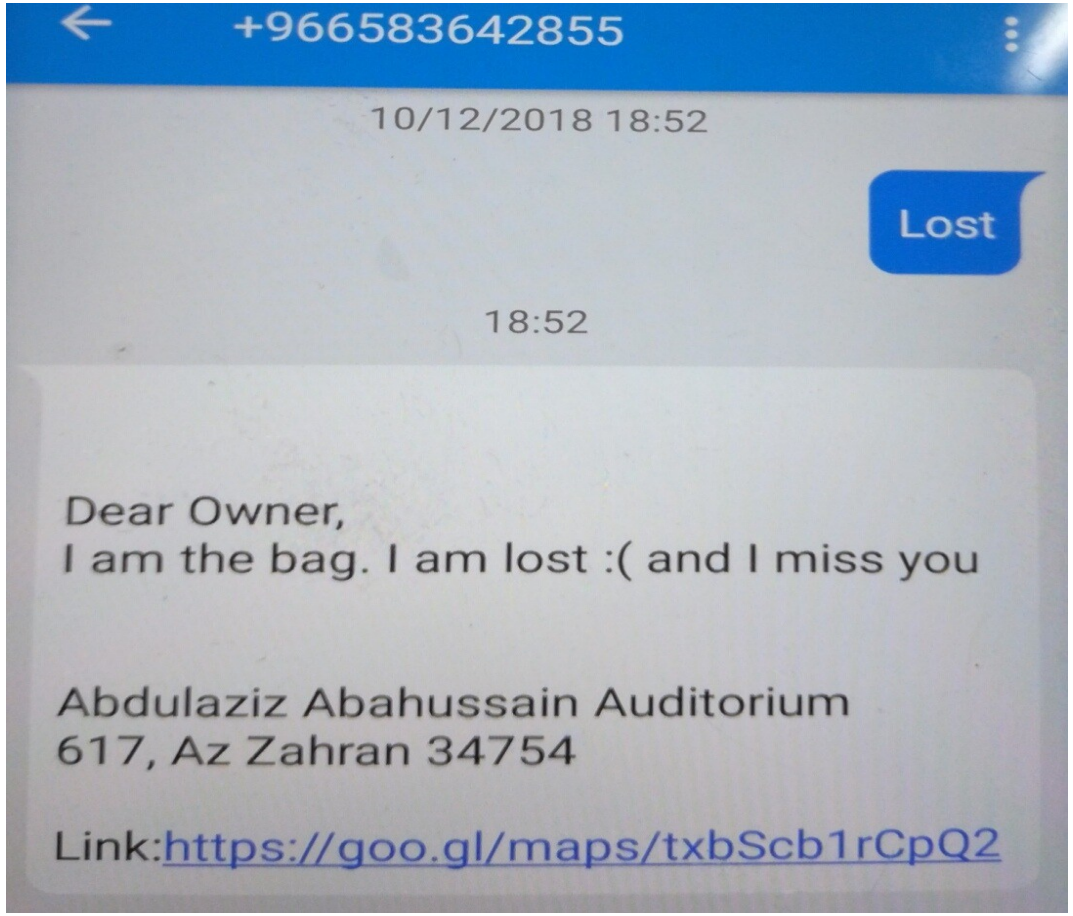
iii. Sensory

Completed Work (1)

- **Wireless Communication**
  1. Installed and wired the GPS and Antenna.
  2. Installed and wired the GSM Shield.
  3. Installed Sim card.
  4. Installed and wired the Bluetooth module.
  5. All were Tested SMS were Sent and receive with location Info.
  6. Programming the codes of the sensors and electronics

SMS massage shows the specific location of the suitcase with a link to display easily on Google maps!





Completed Work (2)

- **User following autonomous mode**
  1. Installed and wired the motors
  2. Tested the motor (Forward/Reversed) & (Right/Left)
  3. Installed and wired the camera
  4. Tested the camera with different colors
  5. Installed and wired the Ultrasonic
  6. Tested the ultrasonic in measuring distance
  7. Programming the codes of the sensors and electronics

The camera and the ultrasonic sensor shows on the front side of the bag

Completed Work (3)

- **Sensory**
  1. Installed and wired the Accelerometer, buzzer and LCD screen
  2. Programming the codes of the sensors and electronics
  3. Tested the sensor's functionality

Massage Shows the owner contact Information

Main challenges

Autonomous mode is a huge challenge

- Ping sensors failed
- Image recognition is very complex
- Limited timeframe

Integrating all systems together

Falling Sensing Video

Manual control Video

Autonomous Following Video

Thank You

Qs & As