The Spanish inventor Leonardo Torres-Quevedo (Fig. 1) is known for a number of ingenious inventions. Most of them were discussed in papers dedicated to his work, such as the one written by B. Randell [1] or the one included in the prestigious Scientific American Supplement [2]. It can also be cited the paper published in the Proceedings of the IEEE by A. Pérez-Yuste and M. Salazar-Palma [3].

On March 16, 2007, the IEEE Milestone ceremony dedicated to the Telekino of Torres-Quevedo was celebrated in Madrid (Fig. 2). So, let us take this opportunity to review the historic significance of this invention and the features that make it a significant technological achievement.

I. THE ART OF MOVING OBJECTS AT A DISTANCE

Not considering the early work done by nineteenth-century scientists on electromagnetic induction, it can be stated that the first practical ideas on the action of a force at a distance were turned into reality after two famous conferences given by the British physicist Oliver Lodge at the Royal Institution in London and the British Association in Oxford in 1894 [4].

At that time, Lodge made use of a Branly’s coherer to detect an electromagnetic wave. This type of radio-sensitive device considerably increased its conductivity when a high-frequency current flowed through it, allowing a secondary circuit to be closed through a local battery in order to execute a predefined mechanical action. Lodge made use of a mirror galvanometer to signal the reception of an electromagnetic wave, but other possibilities were soon suggested.

In a demonstration that took place on December 12, 1896, at the Toynbee Hall of London, Guglielmo Marconi and William Preece, Engineer-in-Chief of the British General Post Office, made a bell in a box ring by pushing a button in a different box, with no wires or cables in between. Likewise, a Morse receiver could be used instead of the ring, and a Morse manipulator, instead of a button, to create a complete wireless telegraph system, such as the one suggested by Marconi in his patent application filed that year [5].

Other innovative proposals came from the military sector. For example, it is well known that some applications were suggested for controlling from a distance the steering gear of ships, torpedoes and other floating bodies electrically. That was the case, among others, of the electrical engineers Axel Orling and Colonel Carl Braunerhjelm in Sweden [6] (1897), the electrical engineers Ernest Wilson and Charles John Evans in the United Kingdom [7] (1898), and the civil engineer Lionel Varicas and his son, Cecil John Varicas, also in the United Kingdom [8] (1898).
Moreover, W. J. Clarke, General Manager of the U.S. Electrical Supply Company, devised a procedure to fire mines at a distance without wires. He gave a public demonstration at the Electrical Exhibition celebrated at the recently completed Madison Square Garden in New York on May 6, 1898 [9]. On the occasion of that exhibition, Nikola Tesla also showed a well-known radio-controlled scale model vessel. In addition, he applied for a patent, which he called “Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles”, where its operation principles were described [10].

II. THE TECHNIQUE USED BY TORRES-QUEVEDO

These proposals, and others not cited above, were all based on a very simple technique known as “on/off”, so they were able to discriminate whether an electromagnetic wave was being received, acting in a different way depending on the case. For example, the rudder could be steered to the left when the electromagnetic wave was received and to the right otherwise. This means that operation could be easily accomplished, for example, by actuating the valve of a steering engine that was worked by compressed air, jointly with a counter spring that turned the steering appliance in the opposite direction. Then, by switching the aforesaid valve continuously on and off, it was possible to maintain a certain direction of movement.

In the case of Tesla, the receiver was even a bit more complex because it had three states of operation, not two: “on”, “off”, and “still”. So, the rudder could be turned to the right, turned to the left or kept unmoved. These three states allow the selection of a direction for the vessel by means of an approximation process so, once reached, it was very easy to maintain it: ordering the rudder to turn in one direction, stopping it, ordering it to turn in the opposite direction, stopping it, ordering it to turn in the first direction again, stopping it, and so on, until obtaining the exact course desired.

But in Tesla’s remote-control system, the propelling engine could not be directly controlled at a distance. Furthermore, it was coupled to the rudder in such a way that the motor was stopped when the rudder was turned beyond an angle of 45° from the zero position (no matter to the left or to the right) and was put in motion when the rudder was turned less than the said angle.

Keeping all these restrictions in mind, Torres-Quevedo suggested a very innovative idea by establishing an easy method for controlling any mechanical or electrical device with different states of operation. He devised a remote-control system that
required two things: a transmitter, which was capable of sending a family of different codewords by means of a binary telegraph signal, and a receiver, which was able to set up a different state of operation in the device being used, depending on the codeword. Putting both things together, he invented the Telekino, a word that came from Greek: tele (far, at distance) and kino (movement), resulting “movement at a distance”, which was the desire of the Spanish engineer. In the description of his patent, Torres-Quevedo wrote about the Telekino in these terms:

“The invention comprises essentially a telegraphic transmission with or without wires determining the position of a needle which regulates a ‘servomotor’ (controller, switch or motor) that actuates any apparatus” (Fig. 3).
By applying the Telekino to electri-
cally powered vessels, Torres-Quevedo
was able to select different positions for
the steering engine and different
velocities for the propelling engine
independently. He was also able to
act over other mechanisms such a light,
for switching on or off, and a flag, for
raising or dropping it, at the same time.
Specifically, Torres-Quevedo was able
to do up to 19 different actions with his

III. THE TRIALS CARRIED
OUT WITH THE TELEKINO

In 1901, Torres-Quevedo concentra-
ted on the development of a new type
of dirigible balloon based on an
internal frame of flexible cables,
which bestowed rigidity on the aero-
stat making use of the gas pressure
(Fig. 4). That was an innovative
proposal in contrast with the existing
rigid internal frame airships, such as
the one invented by the German
count Von Zeppelin or the nonrigid
ones, such as that invented by Brazi-
lian aviation pioneer Santos-Dumont.
The Spanish inventor thus combined
the advantages of the two models,
solving the transport problem suf-
fered by the former and the basket
suspension and stability issues affect-
ing the latter [12], [13].

But the testing of new airships
always entails great risks for pilots, who
are exposed to accidents that endanger
their own lives. So, Torres-Quevedo
immediately began to think about a
wireless remote-control device in order
to avoid those contingencies. The
result was the aforesaid Telekino.

Once Torres-Quevedo had created
the first prototype of his Telekino
(Fig. 5), he applied for a patent in
France [14] (December 10, 1902),
Spain [15] (June 10, 1903) and Great
Britain [16] (December 10, 1903). At
the same time, he began his first
practical trials in the recently created
Centre for Aeronautical Tests
formed by the Spanish Government
in January 1904. The Centre was locat-
ed in a nonused pelota court in Madrid
called Beti-Jai and Torres-Quevedo
was designed as its first director.

At the Centre, Torres-Quevedo con-
ducted his first experiments with a
tricycle, which he controlled by radio
to make it go forward or backward and
turn right or left. He sent orders from a
wireless telegraph transmitter from a
distance of up to about 30 m. Next, more
complex trials were followed by extend-
ing the use of his Telekino to an
electrical engine-driven boat at the Royal
Country House Lake of Madrid, achiev-
ing distances of up to about 250 m [17].

Fortunately, the Mayor of the City of
Bilbao happened to be present at one of
those trials. Being so astonished by the
view of an unmanned boat, he immedi-
amely organized a fundraising campaign
to promote new trials with the Telekino
of Torres-Quevedo at the famous Estuary
of Bilbao, sited in the north of Spain.
Those were finally carried out on
November 7, 1905, using a dinghy with
a crew of eight, which was controlled at a
distance over 2 km [18], [19].

In view of the success of all these
trials, Torres-Quevedo asked for eco-
nomic support from the Spanish Minis-
ter of the Navy in order to test the
Telekino with submarine torpedoes. But
the minister rejected Torres-Quevedo’s
request, arguing that it was not worth-
while to invest any money when similar
experiments were being carried out in
France by other people.

Such an unexpected answer
must have been discouraging to
Torres-Quevedo, who abandoned the
development of the Telekino forever,
with the exception of some trials
repeated in the Estuary of Bilbao on
September 25, 1906, in the presence of
King Alfonso XIII. In addition, it was
not even known that Torres-Quevedo
made use of the Telekino for steering
unmanned aerostats, which was the
first reason for it’s being created.

So, the lack of institutional sup-
port put a sad end to the Telekino, an
invention that was the predecessor of
modern remote-control systems; an
invention that nowadays has changed,
probably more than any other, the
way human beings interact with
technology and the manner in which
we manage machines.

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